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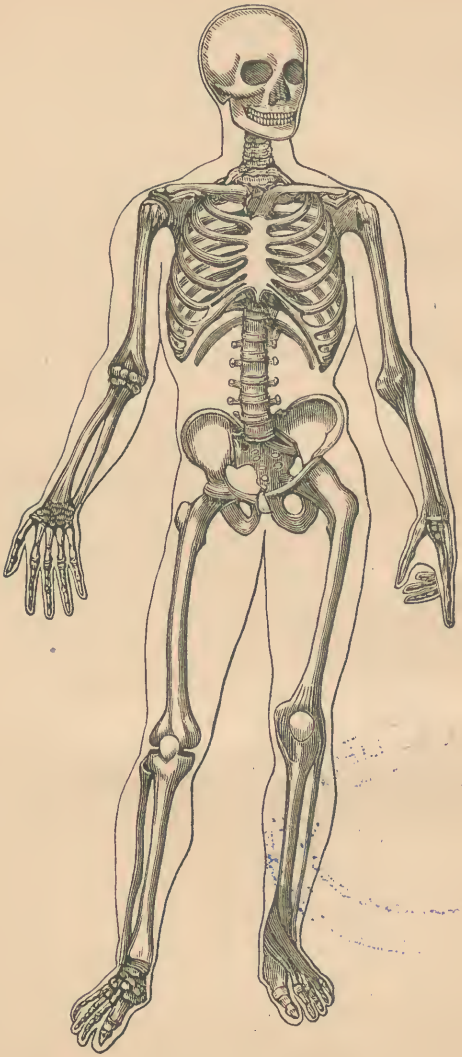

SKELETON.

THE OUTER LINES SHOW THE FORM OF THE HUMAN BODY WHEN THE SKELETON IS CLOTHED WITH FLESH.

HEALTH LESSONS

For Beginners.

A PRIMER OF PHYSIOLOGY AND HYGIENE, AND SIMPLE TREATISE ON THE EFFECTS OF STIMULANTS AND NARCOTICS UPON THE HUMAN SYSTEM.

BY

ORESTES M. BRANDS,

AUTHOR OF "LESSONS ON THE HUMAN BODY," PRINCIPAL OF GRAMMAR SCHOOL, PATERSON, N.J.

LEACH, SHEWELL, & SANBORN,

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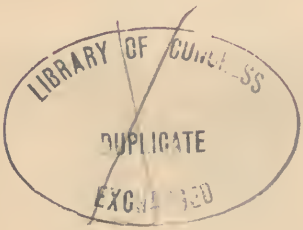

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PREFACE.

NOTHING that the author could say by means of prefatory remarks would either add to or subtract from the merits of this little book. My fellow-teachers and the intelligent public will form their own opinions of its worth. It must speak for itself.

Acknowledgment is due to DR. HERMAN BENDELL, the eminent oculist of Albany, N.Y.; to DR. A. W. CALHOUN, *Professor of Diseases of the Eye, Ear, and Throat in the Atlanta Medical College;* to DR. E. M. HUNT, *Secretary of State Board of Health, N.J.*, DR. WM. K. NEWTON, *Inspector of Health, Paterson, N.J.*, for valuable data; and to other eminent medical authorities, to whose kind favor the author is indebted.

Last, but by no means least, to his fellow-teachers, and to school officers in many States, the author expresses his gratitude for the kind reception given his former work, "Lessons on the Human Body," and trusts that they may find this still more easy book worthy of continued favor.

O. M. B.

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THE MUSCLES.

THE BRAIN AND NERVES.

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THE FRAMEWORK.

LESSON I.

THE BONES.

(*a*) **Nature and Uses of the Bones. — 1.** The bones are the framework of the body. They are to our bodies what the timbers are to a house, for they give shape and firmness, and support the other parts. We could not stand up if we had no bones, nor could we walk, but would have to crawl like worms. To fit the bones for their uses, the all-wise Creator has made them of two substances, one of which makes them firm, the other, tough.

2. If we burn a bone in a fire, nothing is left but brittle lime; and if we soak a bone in acid, the hard lime in it dissolves, and leaves a substance like glue. The earthy matter, or lime, makes the bones firm and hard, and the glue-like part makes them tough and slightly elastic. Thus, you see, that if the bones had no earth in them, they would bend like gristle; and,

if they had only earth in them, they would be as brittle as in the case of the burnt bone, and would soon be broken in many places. You would not dare to run, jump, or play as you do now, for you would not risk the certainty of being broken into small pieces! But your bones have less earthy matter than those of old people, and are not so brittle. When broken, they unite more quickly than the broken bones of the aged do.

3. Bones are of many forms; some are round and long, others broad and flat, and still others short, thick, and irregular. The *long bones* of your limbs are hollow. They are stronger than the same bone would be if it were solid. Roll a narrow strip of paper into a long tube, or "lamp-lighter," and notice how much stronger it is in that form than when folded into a slender, solid stick. The *flat bones*, as in the skull, have two hard plates with a spongy layer of bone between. These give much better protection to the brain than a single thick plate would. Jars from blows do not shock the brain so much through the two plates. The *short, thick bones* are found where much strength in small space is needed. Everywhere you will notice how nicely every part is fitted in the best possible way to do what is required of it. All are joined together for protection and for motion.

(*b*) **Joints. — 1.** The bones of the skull are joined together so that they do not move. These bones are fitted together by a kind of notched joint. These joints are called *sutures*, and they aid in protecting

the brain from sudden jars. Fig. 2 shows the joints at the top of the skull.

EXPLANATIONS OF FIG. 2.

a, *a*, the *coronal suture.*
b, the *sagittal suture.*
c, the *lambdoidal suture.*
d, *d*, *ossa triquetra*, small ragged bones, occasionally found in some skulls, lying in the last-mentioned suture.
e, *e*, portions of the *temporal bone*, overlapping the walls.
1, the *frontal bone.*
2, 2, the *parietal bone.*
3, the *occipital bone.*

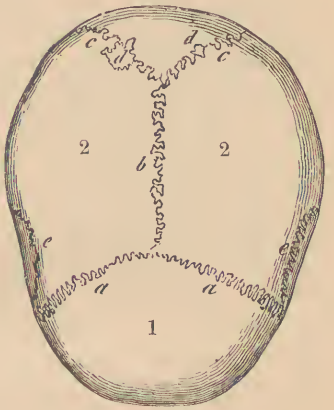

FIG. 2.

2. There are *movable* joints in almost all parts of the body, so that the muscles may move one bone upon another. These joints are so contrived that they may not wear out in a long lifetime, and often they are nearly as good at the end of seventy or eighty years as when they were first used. In machines made by men the joints wear out even when constantly oiled. Our bony joints need no such care from us, for they keep themselves oiled. In order that the bones may move easily and smoothly, their ends are covered with very smooth gristle, which is kept constantly moistened by the "joint water." Strong cords or bands of a very tough substance, at or about the ends of the bones, bind them together quite firmly. The joints may be wrenched and the

bones put out of place by falls, sudden jars, or by blows. Rough twisting of the bones sometimes tears the ligaments and soft parts attached to the bones at the joints, and such an injury is called a *sprain.* Children who are rough in their play may sprain joints; and a sprain is often more painful and serious than a broken bone.

3. Some joints are formed by the rounded head of one bone fitting into a socket in another. Your shoulder-joint and hip-joint are of this kind, and are called *ball-and-socket joints.* These joints allow motion in almost every direction; but for this very reason the bones slip out of joint more frequently than in other joints. Fig. 3 shows the shoulder-joint.

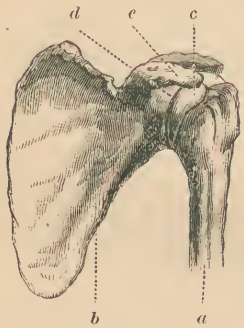

Fig. 3.

Explanation of Fig. 3.

In this cut is seen the union of the head of the humerus with the shallow socket of the scapula. These bones are represented as detached from the body, and the view is a front one.

a, the *humerus*, or arm-bone.

b, the *scapula*, or shoulder-blade.

c, the head or ball of the *humerus*.

d, rim of the socket of the *scapula*.

e, processes of bone that overlap and protect the joint.

It is easily put out of joint because the socket is so shallow; but if it were deeper, the arm could not move so freely. In Fig. 4 you have a picture of the hip-joint. Here the socket is deeper, and the move-

ment is not quite so free as in the shoulder; but it is very secure.

EXPLANATION OF FIG. 4.

We have here an excellent representation of the upper end of the *femur*, or thigh-bone, and half of the *pelvis*. The ball, or head, of the femur, supported by a neck which forms an obtuse angle with the body of the bone, is fixed in the socket of the *os innominatum*, filling the cavity, but not all enclosed by it. The depth of the socket is only about half the diameter of the ball.

a, the *os innominatum*, or hip-bone.
b, the head of the *femur*, or thigh-bone.
c, the rim of the socket.
d, the *femur*.
e, the *sacrum*.
f, the point of bone on which we sit.

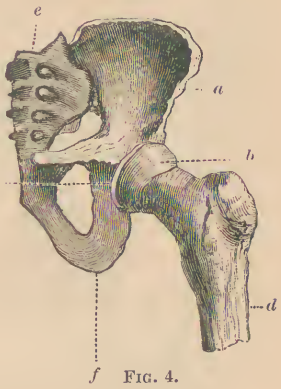

FIG. 4.

4. In your elbows, knees, fingers, and toes are joints that move like a hinge. They allow the bones to move back and forth on the same line, just as a door swings on its hinges. These joints are called *hinge-joints*. Fig. 5 is a picture of the bones of an arm. There are two bones, you notice, in the arm below the elbow: one of these rolls over the other in such a way that you can turn the palm of your hand up or down, etc. In the wrist are two rows of irregular bones, four in each row. In the thumb there are two bones, while each finger has three. The varying length of our fingers and their numerous joints make our hands wonderful instruments for handling. No other animal has so perfect an instrument for this purpose. To his brain and his hands man owes his superiority over all the lower animals.

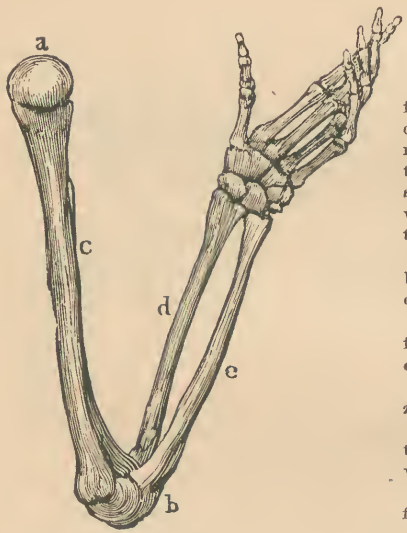

FIG. 5.

EXPLANATION OF FIG. 5.

All the bones of the arm, fore-arm, and hand, are here exhibited in connection, with reference to impressing it on the mind, after having read a short description of the individual parts of the upper extremity.

a is the head of the arm-bone, articulated to the shoulder.

b, the joint, or elbow, formed by the *ulna* and lower end of the arm.

c, the shaft of the *os humeri*, or arm.

d, the *radius*, or handle of the hand, united solely to the wrist.

e, the *ulna*, which alone forms with the arm the joint.

LESSON II.

MORE ABOUT THE BONES.

(*a*) **The Chest, etc. — 1.** Notice the cone-shaped set of bones that form the bony cage called the *chest*. The slender ribs, twelve on each side, go round it like the hoops of a barrel. They are joined to the backbone behind and to the flat breast-bone in front, except the two lower ones on each side, which are free in front. They are joined front and back in such a way as to move up and down when we breathe.

A Back View of the Skeleton.

The Head.

a, the parietal bone.
b, the occipital bone.
c, the temporal bone.
d, the cheek-bone.
e, the lower jaw-bone.

Neck and Trunk.

a, the bones of the neck.
b, the bones of the back.
c, the bones of the loins.
d, the hip-bone.
e, the sacrum.

Upper Extremity.

a, the collar-bone.
b, the blade-bone.
c, the upper bone of the arm.
d, the radius.
e, the ulna.
f, the bones of the wrist.
g, the bones of the hand.
h, the first row of finger-bones.
i, the second row of finger-bones.
k, the third row of finger-bones.
l, the bones of the thumb.

Lower Extremity.

a, the thigh-bone.
b, the large bone of the leg.
c, the small bone of the leg.
d, the heel-bone.
e, the bones of the instep.
f, the bones of the toes.

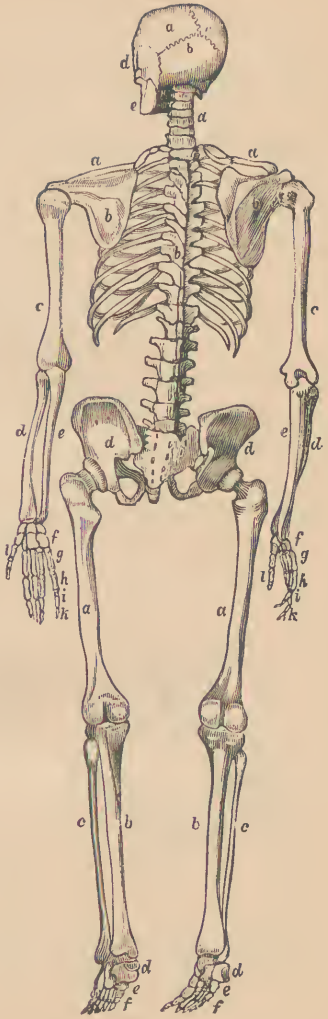

Fig. 6.

Inside of this cage of bone are the heart and lungs. See Fig. 9.

2. The *backbone*, as it is called, is not a single bone. It is a pile of twenty-four bones placed one above another like a column of spools. These bones are very irregular in shape, having pointed ends or spines to which muscles are fastened. You may plainly feel some of these spines in your back, and see where they are in the back of another person. If it were all one bone, you could not twist and bend your body as you can now. In the centre of each bone is a hole, and as the bones stand one upon another, these holes form a long tube in which the spinal marrow is found. This "marrow" is really a great nerve extending down from the brain through the bones. Here is a picture of one of these bones.

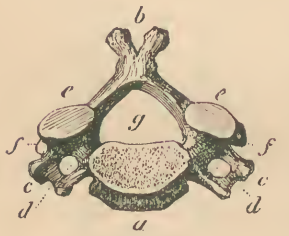

FIG. 7.

EXPLANATION OF FIG. 7.

This is an accurate drawing of one of the bones of the spine, at the neck.

a is the *body* of the bone.

b, the *spinous process*, or handle, which gives the name of spine to the whole column.

c, *c*, the *transverse processes*, to which the muscles adhere, producing motion.

d, *d*, round holes, through the arms of the bone, for safely lodging an artery, which carries blood to the brain.

e, *e*, the upper, and *f*, *f*, the under surfaces, which make a joint with the blocks above and below it.

g, the hole through which the spinal marrow, or pith of the back, passes in safety from the head, through the whole chain of twenty-four vertebræ.

3. Between each two of these bones is a pad of gristle. These pads are the springs, as it were, of the back. They allow considerable motion also. If it were not for them the head and brain would suffer greatly from the jar of walking, etc. These pads grow slightly thinner from the weight they bear during the day, so we are not quite as tall in the evening as in the morning; they recover their thickness while we rest at night. For the same reason the backbone becomes a little shorter in old age. The pads do not recover their thickness, or they shrink a little. The backbone is not straight. It has four curves, two forward and two backward.

(*b*) **The Legs and Feet. — 1.** One long bone forms the thigh. This is the longest bone of your body. The knee-joint is covered in front by a chestnut-shaped bone which protects the joint. Below the knee you notice two long bones, one on the inner and the other on the outer side of the leg. The inner and larger one is the shin-bone. The more slender, outer bone seems to be a kind of brace for the other, and it offers a place for fastening muscles. The lower ends of these two bones may be felt at the ankle.

2. The *foot* is formed of bones much like those of the hand. There are as many bones in it as there are in the hand, but it does not have as much variety of motion. Its arched form serves to break the force of falls or jars, and it also gives spring when we step.

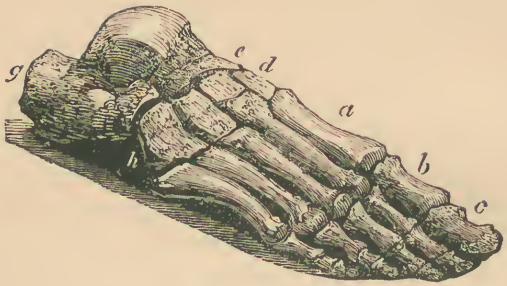

FIG. 8.

EXPLANATION OF FIG. 8.

By this diagram the skeleton of the foot will be clearly understood, even without the aid of the bones. Twenty-six bones are here so curiously grouped together, that an arch is made between the heel and ball of the great toe.

a shows the five bones of the *metatarsus*.

d, *e*, *g*, and *h* point out the five bones of the instep, or *tarsus*.

b and *c* indicate the *phalanges*, or toes.

LESSON III.

CARE OF THE FRAMEWORK.

(*a*) **Exercise.** — **1.** The health of the bones, as much as that of any other portion of the body, depends upon their proper nourishment and exercise.

2. When a child is feeble and unhealthy, or when it grows up without exercise, the bones do not become firm and hard as they do when healthfully developed by exercise.

3. The size and strength of the bones, to a considerable extent, depend upon exercise and good health.

(*b*) **Dress and Deformity.—1.** Distortion of the spine and bones of the chest may be caused by tight clothing about the waist. Tight clothing presses the lower ribs inward, prevents their free movement, and interferes with the full expansion of the chest and lungs in breathing. It also distorts the liver, and interferes with its healthy action. When worn by young people, before the bones have become hard, tight clothing prevents the growth of the chest, and changes its natural form. Clothing should be sufficiently loose and easy to allow free movement and growth of the bones enclosing the vital organs.

2. You should learn to sit and stand erect. If you get a bad habit of stooping over or leaning too much to one side while sitting at your desks or while standing, you may become deformed. The pads of gristle in your backbone will be pressed thin on one side and remain thick on the other. This gives them the shape of a wedge. They sometimes harden in this wedge shape, and then you could not straighten up. You would either have a stoop forward like an old person, or your backbone would be bent sidewise, and one shoulder would be higher than the other. Your desk should not be so high that it causes you to sit with one shoulder raised higher than the other.

3. *Our feet* should be as free from pain and disease as our hands. They would be, if we did not cramp the bones and joints and make them centres of pain by wearing shoes too short, or too narrow, and sometimes both. Five toes are often crowded

into space not large enough for three. The joints of the great toe are pressed out of place, and the bones and joints of the smaller toes become bent and twisted. The nails are caused to grow down into the flesh, and corns and bunions give us distress when we unwisely wear shoes that pinch the feet. Very high heels, too, throw our weight forward upon the cramped toes, and strain the joints of the foot and leg.

4. No doubt many people have died of consumption from want of exercise in the open air, not because they were lazy, but because their feet hurt them when they tried to walk. Your shoes should be perfectly easy.

LESSON IV.

THE TEETH AND THEIR HEALTH.

(*a*) **Temporary and Permanent Teeth.** — **1.** The teeth which appear in infancy begin to be shed about the seventh year. These are called *temporary* or milk teeth, and there are twenty of these, — ten in each jaw. They give place to the stronger *permament* teeth, thirty-two in all, — sixteen in each jaw. The teeth are composed of bone-like material, covered at the *crown*, or exposed part, by a thin, hard enamel. Blood-vessels and nerves extend into the bony part of the teeth.

2. Do you wonder why the first teeth are shed? Well, the bones grow larger, but the teeth do not. The bones of the jaws grow larger, and if the first teeth were not shed, they would be too small for the jaws. They would stand far apart, look very strange, and would not be as useful as at first. So they begin to be shed as the jaw-bones grow, and the new set of larger teeth come instead.

(*b*) **Care of the Teeth. — 1.** After each meal the teeth should be well cleaned, using a brush, or a bit of flannel, and water. Particles that lodge between the teeth should be removed by a thread or a wooden toothpick; for, if allowed to remain, they putrefy, make the breath offensive, and cause decay of the teeth. Decayed teeth, *if "filled" before toothache sets in*, may still be preserved for many years.

2. To brush the teeth well, place the points of the upper and lower front teeth together, and use the brush up and down. The back teeth need more brushing than the front ones. Brush the inner sides of the teeth as well, and give the gums a little brushing to toughen them.

3. Use a brush that has just as stiff bristles as may be used without making the gums bleed. A soft brush is not much better than none, for the bristles bend and fail to clean the teeth.

4. Strong tooth-soaps contain much alkali and are injurious. It is not best to use any powder or mixture that leaves the mouth parched and drawn. Hot as well as cold water may crack the enamel.

Tepid water is best always. A very good tooth-powder is composed of orris root, English prepared chalk, and powdered Eucalyptus leaves.

5. The teeth are not intended to be used in cracking nuts, breaking thread, and tearing cloth; and whether false or natural, the same care of them is required for cleanliness and health.

DIGESTION.

LESSON I.

WHY WE NEED FOOD.

(*a*) **Food and Hunger.** — **1.** Waste and worn-out material is constantly being cast out from our bodies. The lungs and the pores of the skin are busily engaged in this work.

2. If new material be not supplied to take the place of the worn-out substances, the body would dwindle and die. Without food, a man will starve in a few days.

3. When the body needs material to take the place of that which is worn out, the nerves of the stomach become active in a peculiar way; and, when the sensation is carried to the brain, we recognize it as *hunger*.

(*b*) **Food and Force.** — **1.** All the strength of our bodies comes from the food we eat. After the

food has gone through the different processes of digestion, it gives up to the blood properties that supply the body with nourishment and strength. Just as new fuel feeds the fire, so does food keep up the forces of the body.

2. The waste of bodily substance varies in different persons, and in the same person under different circumstances. Great bodily action causes great waste or wearing-out of the particles.

(*c*) **What Digestion is. — 1.** Food is not in condition to be taken into the blood from the stomach as soon as it reaches that organ.

2. The food must be changed in various ways to prepare it for the use of the body. These changes are called *digestion.*

(*d*) **The Digestive Machinery or Organs. — 1.** The organs of digestion are, —

1. The *mouth* and *salivary glands.*
2. The *stomach.*
3. The *pancreas.*
4. The *liver.*
5. The *intestines.*

2. These organs, together with the passages that connect them, form the *alimentary canal.*

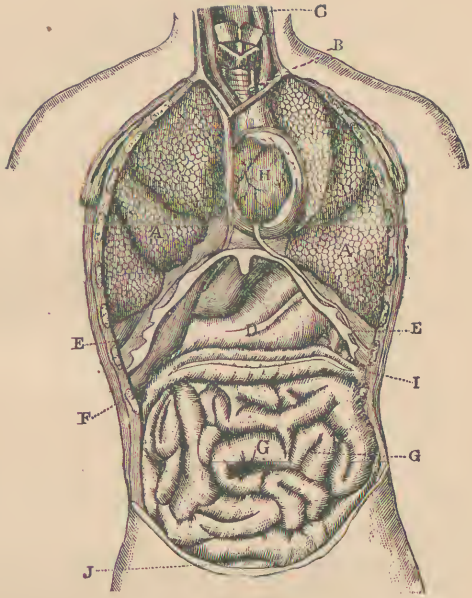

Fig. 9.

Explanation of Fig. 9.

This figure represents the organs of the chest and abdomen in natural position, the breast-bone and ribs being removed.

B, the *trachea* (windpipe).
C, *œsophagus* (gullet).
E, *diaphragm.*
F, *liver.*
I, *spleen.*
D, *stomach.*
G, *intestines.*
H, *heart*, the pericardium being laid open.
A, *lungs.*
J, *bladder.*

LESSON II.

HOW FOOD IS DIGESTED.

(*a*) **Work of the Mouth. — 1.** When food is put into the mouth, the tongue rolls it about and keeps it in place between the teeth, and the teeth cut and grind it to a fineness suitable to the stomach.

2. While the food is being moved about by the tongue, saliva or spittle is poured into the mouth from little glands or sacs situated in the cheeks and under the tongue The saliva moistens the food, brings out its taste, and changes starchy particles into a kind of sugar, and thus begins the work of digestion.

3. When the food has been acted upon by the teeth and saliva, it is pushed backward and passes into the gullet or upper opening of the food-tube, which leads downward to the stomach This tube, called the *œsophagus*, is covered by layers of muscles, one of which extends lengthwise, while the other winds around it from end to end; and when food enters it from the mouth, the uppermost band of muscle closes upon it and forces it downwards. Each successive band repeats the act of the first, till the food is finally deposited in the stomach.

(*b*) **Work of the Stomach. — 1.** The stomach is situated mainly on the left side of the abdomen, just within the lower ribs. Its shape is like that of a shot-pouch, and it is composed of three coats, the

outer one being tough and strong, the middle one muscular, and the inner one loose and spongy.

2. When food enters the stomach, a liquid called *gastric juice* pours out from the inner coat; the muscular coat contracts and expands, and keeps the food in constant motion, mixing it with the gastric juice. This juice dissolves the *albumen* of the food, and changes the mass into a pulp, called *chyme*. The chyme is now ready to pass out of the stomach, through an opening at its right end, into the intestines.

EXPLANATION OF FIG. 10.

1, the œsophagus.
2, the left opening of the diaphragm.
3, the cardiac orifice of the stomach.
4, the small curvature of the stomach.
5, the great curvature of the stomach.
6, the fundus of the stomach.
7, the pyloric orifice.
8, 9, 10, the duodenum, divided into three portions.

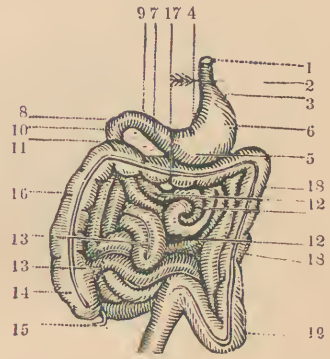

FIG. 10.

(*c*) **Work of the Intestines, etc. — 1.** When the chyme enters the intestines from the stomach, the liver pours into it a bitter liquid, — the *bile;* and another organ, called the pancreas, pours in *pancreatic juice.* These two juices act upon fatty atoms of the chyme, and upon starch or sugar not changed

by the saliva. The chyme is thus changed into a milky liquid called *chyle*.

2. Passing along, the chyle is absorbed through the inner lining of the intestines, and is conveyed by countless numbers of tiny tubes into a larger tube. This larger tube carries the chyle upward, and pours it into a vein under the left collar-bone, where it mingles with the old blood and passes into the heart.

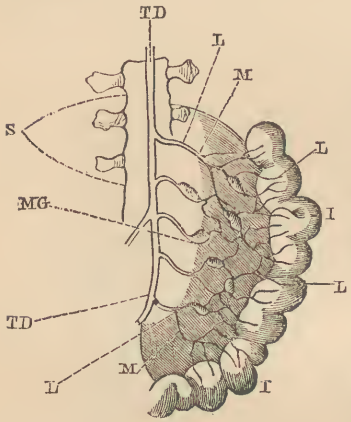

Fig. 11.

Explanation of Fig. 11.

A portion of the *thoracic duct* marked TD above, and TD below, lying in front of and in contact with the spine, S.

By the side of II is seen a portion of intestine attached to the mesentery, a kind of membranous ruffle, around the border of which the entire tube of the intestine is fastened.

LL show a lacteal vessel running from the inside of the intestine, charged with a milky fluid which is conducted into the mesenteric glands, seen lying between the two folds of that membrane. In these the chyle is essentially changed in character, and perhaps receives additional fluid from the gland itself. From these the fluid next passes on through the excretory ducts, MM, which join the main trunk of the thoracic duct.

LESSON III.

HINTS ABOUT EATING.

(*a*) **When to eat.** — **1.** Meals should be eaten at regular hours. If we eat at irregular hours and between meals, the stomach is kept almost constantly busy, and may become so weak as to be unable to do its work. It is best to take three meals a day, five or six hours apart.

2. The stomach does its work best when the mind is at ease and the body is rested. Children should not take a meal when they are heated and excited by play. It is best to give the body a short rest, and the nerves a chance to become quiet, before eating. Again, it is best to keep the body quiet for a time after a meal. Moderate exercise will do no harm; but running, leaping, jumping rope, etc., should not be engaged in for at least a half-hour after eating. A meal should not be eaten just before going to bed, for rest may be disturbed in this way.

(*b*) **How to eat.** — **1.** We should not eat hurriedly. The food should be well chewed and mixed with the saliva. "Food well chewed is half digested;" and the stomach cannot do the chewing.

2. We should guard against eating more food at one time than the stomach can change into chyme. If food is not properly digested, it becomes sour and even putrefies in the digestive organs.

3. It is not best to take a swallow of tea, coffee, or water, with every morsel of food. These liquids dilute the saliva and gastric juice, and in this way interfere with digestion. If cold liquids are swallowed, the temperature of the stomach will be lowered, and digestion delayed till the stomach regains its warmth. It is best to quench thirst between meals, as a rule.

(*c*) **What to eat. — 1.** Our bodies are composed of about fifteen simple substances or *elements*, and our food should be of a kind that will supply all of these. No one article of food contains enough of all of these elements to properly nourish our bodies; and so it is best to eat a few articles together, and not to depend too much upon a single kind.

2. A mixed diet is best, and this consists of animal, vegetable, and mineral food. Thus, eggs, milk, lean meat, etc., supply the body with the nitrogen it needs; the fruits and vegetables, such as wheat, rye, rice, beans, and potatoes, contain starch and sugar, and supply carbon, hydrogen, and oxygen; butter, milk, meat, and certain vegetables, contain fats and oils, and supply carbon and hydrogen abundantly; while minerals, such as salt, lime, etc., supply needed elements. In very cold climates the people eat food that contains much fat, in order to keep their bodies warm. In very warm climates the people live mainly upon fruits and vegetables, because these are not so heating. In a variable climate

like that of our country, we find a mixed diet best suited to our wants.

3. Food is often made unhealthful by bad cooking. Sour or "heavy" bread, fat mixed and cooked with flour, and food too highly seasoned, are injurious. Food with few mixtures in cooking it is more easily digested and more healthful.

4. When our food causes discomfort we should omit first one article and then another, till the one that troubles us is discovered, and then omit that altogether. Constant carelessness in our habits of taking food will cause us to pay the penalty of dyspepsia, with its long train of evils. We should begin early in life to form good, sensible habits.

LESSON IV.

THE WATER WE DRINK.

(*a*) **Danger of Impure Water.** — **1.** Good drinking-water is of the utmost importance to health. If we drink impure water, we may be attacked by fevers, dysentery, or cholera, as these are known to be frequently caused by bad drinking-water. There is scarcely a well to be found in any of the older cities or villages, the water of which it is safe to drink. And yet people go on drinking the water of these wells and becoming sick, never thinking of the real

trouble until an epidemic of deadly fever or cholera carries off scores or hundreds.

2. We cannot always detect impure water by its taste or smell. It is only when it is extremely foul that this can be done. Water may *appear* pure; and yet, when examined by those who know how to test it, it may be found unfit for use and dangerous to health. But we may all easily learn what causes water to become unfit for drinking.

(*b*) **Sources of Impurity.** — **1.** Streams, springs, and wells may be made impure by filth washed into them from the surface of the ground by rains, or by filth soaking down through the soil and finding its way into them with the water that feeds them. Just as a ditch fills with water from a wet field, so does a shallow well drain water from the surrounding ground; and if the ground near the well is soaked with filthy matter, much of it will get into the water.

2. When wells are first dug in country districts, the water is pure, and many remain so a long time if cesspools, closets, and stables are not near, and if kitchen slops, wash-water, etc., are not thrown upon the ground in the vicinity. In cities and towns where there are many sources of filth — sometimes leaky sewers and drains, or no drains at all — the ground becomes filth-soaked, deeper and deeper, and the impure matter at last appears in the water of the wells.

3. It is not pleasant to think that, when we are

careless about cleanliness and good drainage, we are drinking water that is both filthy and dangerous to health. And still, when cities and villages are without sewers, or when our wells are surrounded by outhouses, cesspools and slops, refuse matter collects without end, and the wells are sunk in filthy ground. When other good water can be obtained, the water of such wells should not be drunk. There is a lesson that should be learned by all, — that there is disease and death in cesspools and filth, and safety in good drainage and cleanliness. "It should be distinctly understood that no amount of artificial 'disinfection' can ever take the place of *pure air*, *good water*, *and proper drainage;* and these cannot be had without prompt and thorough removal of all filth."

4. The terrible epidemic of fever that recently caused the death of scores of people in one of our towns, gave a fearful example of the dangers that may, at any time, come from carelessness or ignorance. The slops from the sick-room of a person having a deadly fever were thrown upon the ground and washed into a stream, poisoning its water and carrying death or disease to all who drank it.

LESSON V.

STIMULANTS AND NARCOTICS.

(*a*) **What Stimulants are.** — Stimulants are substances that, when received into the body, excite the brain and nerves, make the heart work faster and the blood flow more rapidly, and cause intoxication. Many poisons are stimulating in their effects.

(*b*) **What Narcotics are.** — Narcotics are substances that have the power to relieve pain, cause sleep or stupor, and, when taken in sufficient quantity, cause death. They produce these effects by numbing the brain and nerves, or by paralyzing them completely. Narcotics, when improperly used, not only injure the brain and nerves, but also the stomach, heart, and other organs of the body, making them unable to perform their work. Some of these drugs are both stimulant and narcotic; that is, they stimulate at first, and then this effect is followed by the stupefying effect just described.

(*c*) **Some Stimulants and Narcotics.** — Alcohol, opium, tobacco, and chloral are a few of a large number of stimulants and narcotics; and we shall speak of these particularly, because they are the ones that many people have formed the habit of using, to the great injury of health, character, and happiness. They are much alike in some of their bad effects, and the common use of one may lead to the use of the rest.

Alcohol is a clear water-like liquid, of a hot, biting taste. It is very useful in many ways, but is very harmful when used as a common drink, as in brandy, whiskey, rum, gin, beer, etc. It gives to these liquors their power to intoxicate or make drunk.

Opium is the dried juice of the white poppy. It has great power to relieve pain and cause sleep, and is a deadly poison. One grain of it may kill a person. It is often put into cordials and syrups.

Tobacco is the dried leaves of a poisonous plant. Its harmful effects when smoked or chewed are caused by a substance in it called nicotine, which is a rank poison. Five drops of it have been enough to kill a dog.

Chloral is an oily liquid formed from alcohol by passing chlorine gas through it. Mixed with a little water it forms a white crystal. Like opium, it is a very dangerous drug. People are frequently killed by it.

(*d*) **Appetite for Stimulants and Narcotics.** — These medicines — for they are such — have a strange property that causes a craving for more of them, when people foolishly use them without the doctor's advice. Soon this appetite for them grows so strong that it can hardly be resisted, and often not at all. When once this fierce appetite is formed, people find that they are obliged to increase the dose of the drug, or to take it oftener, to satisfy the appetite; and thus the habit grows from day to day. When the effect of one dose passes off, they are miserable till another is taken. You will see that it is ex-

tremely dangerous to tamper with any of these powerful substances.

(*e*) **Alcohol and Digestion.** — **1.** Alcohol absorbs moisture from the lining of the stomach, and leaves it parched and inflamed. This causes a terrible thirst called "Drunkard's Thirst." When much alcohol is drank it thickens the lining of the stomach, destroys some of the glands that prepare the gastric juice, and sometimes causes ulcers in the stomach. It hardens and toughens some articles of food in the stomach so that the juice cannot dissolve them; and besides, it changes the nature of the juice itself, and unfits it to dissolve food properly. In these and other ways it makes a diseased stomach, spoils appetite for food, and injures health.

2. All this is bad enough; but it does more harm still. It sometimes inflames both the liver and the kidneys; or it clogs them with fat and interferes with their work. It has been known to shrink the liver into a hard, lumpy mass. This is called "Drinker's Liver." When the kidneys become clogged up, they cannot cast out waste matter from the blood, and this causes disease. Anything that interferes much with their work will cause disease and death. The terrible "Bright's disease" may be caused by drinking liquor.

(*f*) **Tobacco and Digestion.** — Smoking and chewing tobacco weaken the glands that pour out the spittle, and make it flow too freely. This is injurious because the spittle is needed to aid in digesting

our food, to moisten it, and keep the mouth moist. When it is wasted in being spit out, it can do none of these things. Besides, tobacco lessens the appetite for food and weakens the stomach. It may cause diseases of the mouth, tongue, and throat, too. Many tobacco-users suffer from dyspepsia. Tobacco is most harmful to young people. It does all the harm we have mentioned, and, besides, it stops their growth, — stunts them, — injures the brain and mind, and makes the body weak.

(*g*) **Opium and Chloral.** — Both of these drugs when commonly used destroy appetite for food and interfere with its digestion. They check the flow of the juices that dissolve the food. Both are very stealthy. They fix a terrible appetite for themselves upon the foolish person who begins to use them, and before he knows it he is bound to keep on using them or to be almost or quite crazy when he does not take his regular dose. They should *never* be used unless by the doctor's orders, and then just as he directs. They often cause the death of people who had no intention to commit suicide.

THE BLOOD.

LESSON I.

THE BLOOD.—WHAT IT IS AND DOES.

What and where.—1. The blood is the liquid that circulates through the various parts of our bodies, and conveys material to build up and make good the wear and waste. It is made out of the food we eat, the water we drink, and the air we breathe. If we would have pure, rich blood, we must eat good food, drink pure water, and breathe pure air.

2. It contains, or should contain, all the materials for making every organ of the body. When it does not contain the proper building-material, something is wrong. Either the food is not of the right kind, the water is bad, or the air breathed is not good.

3. The blood consists of a colorless liquid, called *plasma*, in which countless numbers of little circular bodies, or *corpuscles*, float. The greater number of these are red, others are white. The red ones are about $\frac{1}{3200}$ of an inch in diameter, and it would

require 12,800 of them to make a little column an inch high. The white ones are a little larger. The corpuscles carry the oxygen of the blood, which they receive while in the lungs.

4. The blood moves constantly while we live. A current is always flowing from the heart to all parts of our bodies, and from these a current is returning to the heart. These movements are called *the circulation of the blood.* The organs of the circulation are the *heart*, *arteries*, *capillaries*, and *veins.*

LESSON II.

THE HEART AND OTHER BLOOD-VESSELS.

(*a*) **Position.** — **1.** The *heart* is the organ which propels the blood, and is situated just to the left of the centre of the chest.

(*b*) **Construction.** — **1.** The heart is a hollow, muscular organ, shaped like a strawberry, and suspended with the point downwards. Its size is roughly estimated to be equal to that of the fist.

2. It is surrounded by a loose sack of membrane, the *pericardium* (*peri*, about; *kardia*, the heart). The pericardium is as smooth as satin, and gives out a liquid which keeps it moist and pliable.

3. The heart is partitioned into four chambers. The two upper ones are called *auricles* (*aures*, ears), because of the shape of the flaps on their outside

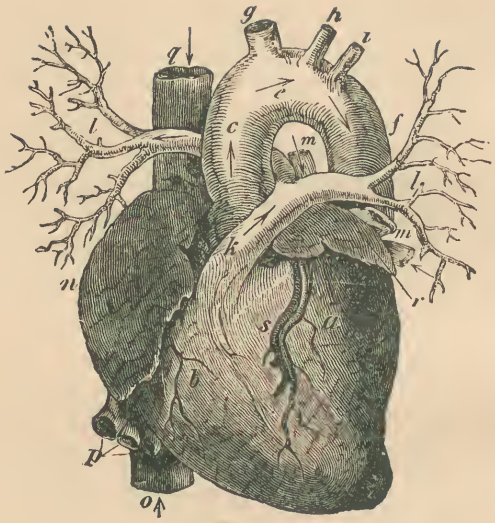

Fig. 12.

Explanation of Fig. 12.

The double heart of man.

q, the *descending vena cava.*

o, the *ascending vena cava.*

n, the *right auricle.*

b, the *right ventricle.*

k, the *pulmonary artery.*

l, *l*, the *right* and *left* branches of this artery, going to the lungs on either side of the chest.

m, *m*, the *veins* of the *lungs*, which return what the artery sent in, to *r*, the *left auricle.*

a, the left ventricle.

c, *c*, *f*, the *aorta*, or great artery of the body, rising out of the left heart.

g, the *arteria innominata.*

h, the *left common carotid artery*, going up the side of the neck to the head.

i. the *left subclavian artery*, going to the left arm.

Note. — The arrows show the course the blood moves in each of the vessels demonstrated with the heart: *n*, the right auricle; *m*, *m*, veins of the lungs; *s*, the left coronary artery; *p*, the veins returning blood from the liver and bowels.

walls. The lower chambers are called *ventricles* (*ventriculus*, the belly).

4. The auricle and the ventricle on the same side communicate with each other by means of openings (*valves*); but the right and left sides of the heart are entirely separated by a muscular partition in which there is no opening.

5. The walls of the ventricles are thicker than those of the auricles. This is a wise provision; for it is by the powerful action of the ventricles that the blood is forced to the remotest regions of the body.

6. The auricles need much less power, for they simply discharge their contents into the ventricles, which are near at hand, and their walls are not so thick.

(*c*) **Work. — 1.** The action of the heart consists of alternate contractions and dilations. During contraction, the walls come forcibly together, and thus the blood is driven out. In dilation or expansion, the walls open or separate, and thus make room for a new supply of blood.

2. The contraction of the right *auricle* drives the blood into the right *ventricle:* the right *ventricle* then contracts, and forces the blood through the *pulmonary artery* into the lungs.

3. Leaving the lungs where the blood is purified, it returns by four *pulmonary veins* to the left *auricle;* the contraction of the left *auricle* drives the blood into the left *ventricle;* the left *ventricle* contracts, and drives the blood into a large artery called the

aorta, the branches of which convey it to all parts of the body, except the lungs, to which it is returned, as first described, after circulating throughout the entire body.

(*d*) **Arteries.** — The arteries are the tubes that conduct the blood from the heart. One great artery, the *aorta*, is given off directly from the heart, and its branches extend to all parts of the body. The arteries nearly all lie deep so as to be out of danger, for, when cut, the flow of blood from them cannot be stopped as easily as from a vein. Their walls are thick and elastic, and aid in keeping up the movement of the blood. Their ends are extremely small. When an artery is cut, the blood spurts out at every beat of the heart; but blood from a vein flows out slowly and steadily.

(*e*) **Capillaries.** — At the ends of the arteries and the beginnings of the veins there are exceedingly small tubes, finer than the finest hair. They form a network between the arteries and veins. They are called capillaries, and are everywhere in the body. Those in the skin, when very full of blood, give the red or pink color to it and to the lips. The walls of these little tubes are very thin. The oxygen and the nourishing materials in the blood soak through them and build up the muscles, bones, etc.

(*f*) **Veins.** — The veins are the tubes that convey the impure blood back to the heart. They begin as tiny tubes in the capillaries, but they unite and become larger and fewer. At last they form two

great veins, one of which brings the blood back from the head and arms, and the other from the trunk and lower limbs. Both of these empty into the right upper chamber of the heart. The blood in the arteries is red, but that in the veins is dark. It regains its bright color when the air in the lungs comes in contact with it. It is supposed that all of the blood passes once through the heart in about two minutes.

LESSON III.

HEALTH AND THE CIRCULATION.

(*a*) **Bad Effects of Improper Clothing.** — **1.** While good food and pure air make good blood, it must circulate freely if we are to have good health. This being true, no article of clothing should fit so closely or be worn so as to prevent the blood from flowing freely through every organ of the body.

2. *Tight clothing about the neck*, tight collars, etc., press upon the blood-vessels that convey the blood to and from the head. The flushed face, feeling of fulness and pressure, headache, or giddiness and fainting are often caused by pressure upon the veins about the neck. The impure blood is prevented from flowing back to the heart, and the pressure may cause the blood-vessels to give way, in which case paralysis or death from apoplexy may occur.

3. *Tight clothing and tight lacing about the waist* obstruct the movements of the blood at this point, and interfere with full breathing. "If a foolish girl," says an author, "by squeezing and lacing secures a wasp waist, she is tolerably certain to gain an addition she did not bargain for, and that is *a red nose*, which, in numberless instances, is produced by no other cause than obstructing the circulation and causing stagnation of the blood in that feature." No less harmful is the custom among men and boys of buckling vest or pantaloons tightly about the waist. It is much better to suspend the clothing from the shoulders.

4. *Tight bands about the limbs* interfere with the circulation of blood, and may cause enlargement and rupture of the veins. At least, discomfort and painful limbs are caused by them.

5. *Tight shoes and tight gloves* obstruct the flow of the blood and cause cold feet and cold hands. Besides, they make the body generally uncomfortable, and lead to irritation and ill-nature.

6. *Insufficient clothing* of any part of the body allows cooling or chill, which drives the blood away from the surface of the part exposed.

(*b*) **The Mind affects the Circulation.** — 1. *Anger and other exciting passions* increase the force of the heart's action, frequently to an alarming extent. There have been instances of the bursting of blood-vessels from a fit of passion.

2. *Sorrow and grief* cause the blood to move too

slowly, and then the power to resist disease is much less.

3. *Good nature and cheerfulness* keep the circulation regular, and in this way aid in maintaining good health.

(*c*) **Bathing and Muscular Exercise. — 1.** *Bathing and friction of the skin* cause the blood to circulate freely toward the surface of the body, and keep the skin in healthy condition.

2. Muscular exercise increases the movements of the heart. The contraction of the muscles, by pressing upon the veins, forces along the current of the blood, and in this way supplies the demand for new material, while the waste particles are taken up and removed more rapidly by the lungs, skin, kidneys, etc.

(*d*) **What to avoid. — 1.** Avoid all things which tend to obstruct the natural and free movements of the blood, as these must always result in disease and shortening of life.

2. Avoid all causes which unduly excite the heart to overwork, for the heart, like any other muscle, may be weakened and made unable to perform its ordinary work. For both of these reasons, avoid all narcotics and stimulants.

(*e*) **Effects of Alcohol on the Blood, etc. — 1.** One effect of alcohol is to make the blood too thin and to unfit it to nourish the body. Another is to shrink the little corpuscles, and then they cannot carry enough oxygen to purify the blood and keep

the body properly warm. It makes the blood impure, and induces fevers and inflammations. It is well known that yellow fever, and some others, are nearly always fatal to those who drink much liquor. Impure blood is the ready-made ground for the seeds of disease.

2. Alcohol makes the heart work too fast and tires it. This overwork weakens the heart and wears it out. Worse than this, alcohol has the power to change muscle into fat. When this takes place in the heart, it becomes so soft that it may burst when it is made to work a little faster than usual. If the muscles of the blood-vessels of the brain change into fat, the pressure of the fast-flowing blood may burst them, and this would cause apoplexy, and end in sudden death.

3. People imagine that alcohol will keep them warm in cold weather. This is a great mistake. At first it hastens the flow of the blood, and the little blood-vessels near the surface of the body become crowded with the warm blood. This causes a feeling of greater warmth there for a short time. But soon the blood ceases to be urged along so fast, and it does not rush to the surface as it did. Then the body is chilled and cannot bear the cold. Alcohol does not protect any one from severe cold. Those who use it cannot bear the cold as well as those who do not drink it.

(*f*) **Effects of Tobacco.**—The poisonous nicotine of tobacco being absorbed into the blood causes it to

become thin. Like alcohol, it tends to fatten and weaken the heart, and causes it to palpitate and act irregularly. Very many tobacco-users suffer from disease of the heart. We sometimes hear of a "tobacco heart."

BREATHING.

LESSON I.

THE ORGANS OF BREATH.

(*a*) **The Air-Passages.** — Air gets into the lungs through *the nose and mouth*, *the larynx*, *the trachea* or windpipe, and branches of the windpipe, called *bronchial tubes*.

(*b*) **The Larynx, or "Adam's Apple."** — **1.** It is the upper end of the windpipe. Its form is seen as a bulge in the front of the throat. It is composed of pieces of cartilage which move upon each other. It opens into the windpipe by a narrow chink, called the *glottis*, which is open except when we swallow anything. It has a small, spoon-shaped trap-door which closes down when we swallow, so that food may glide over it into the food-tube, which is back of it. This little lid is the *epiglottis*. If we attempt to breathe when we swallow, particles of food drop into the windpipe because the door is open.

2. The larynx is the instrument of voice. The opening, or glottis, consists of lips of membrane with very thin edges. These are called "vocal chords." These lips, or chords, spread apart when we breathe, and leave a V-shaped opening; but when we make sounds, they narrow or widen the chink, and thus the sounds made are high or low, etc. The air passing between them causes them to vibrate and make sounds. At about the fifteenth year, the larynx of boys nearly doubles in size, and the voice becomes manly.

(*c*) **The Trachea, or Windpipe.** — **1.** This main air-tube extends down to the lungs. It is composed of tough membrane, and its sides are kept apart by stiff rings of gristle. These may be felt in the front of the throat. At the lungs it sends off two large branches, one into each lung. These large branches send out smaller ones, and these still smaller ones. The tiny branches end in clusters of little air-cells.

2. The air-tubes and passages are lined with a very delicate skin, called *mucous membrane.* This lining is very sensitive and may be injured in various ways.

(*d*) **The Lungs.**—**1.** The lungs are situated in the chest, one on the right and the other on the left, with the heart between them. They are spongy and elastic, but not muscular, being composed mainly of small tubes and air-cells. They are of a grayish-rose color. No doubt you have seen the lungs, or "lights," of sheep, pigs, or cattle. These have given

you a better idea of the lungs than a written description of them can. They have no power to move for themselves in breathing, but are pressed upon by the walls of the chest, moved by muscles. After the air has been forced out of them in this way, the chest is made to expand again, and the air rushes into the lungs by means of the air-tubes, and fills them.

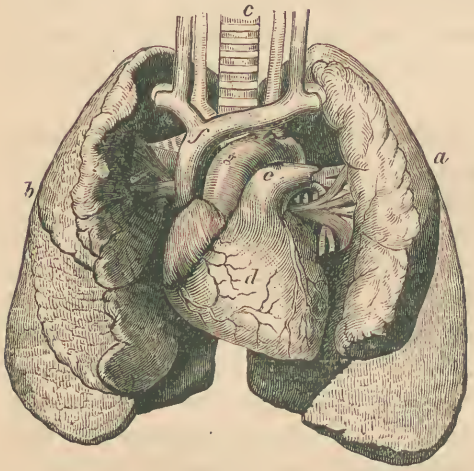

Fig. 13.

Explanation of Fig. 13.

a, the left lung.
b, the right lung.
c, the windpipe.
d, the heart.
e, the great artery carrying blood to the lungs.
f, the great vein.
g, the great artery carrying blood to the body.

2. The oxygen of the air passes through the thin walls of the air-cells and is absorbed into the blood. It mingles with the dark, impure blood, and changes it to a brilliant red. Carbonic gas and watery vapor come out from the blood through the same thin walls, and are cast out when next the air is breathed out. The work of the lungs, then, is to supply oxy-

gen, which is necessary to life, and to remove waste matters that would destroy it.

LESSON II.

THE AIR WE BREATHE.

(*a*) **Of what composed. — 1.** The air we breathe is composed mainly of two gases, *oxygen* and *nitrogen*, there being about twenty-one parts of the former and seventy-nine of the latter. If the air consisted of oxygen alone, it would be too strong; and as *nitrogen* is a harmless gas, it serves to dilute the oxygen and make it fit to support life.

2. Oxygen is necessary to both animal and vegetable life. Animals die when the air they breathe has lost much of its oxygen; and, without it, the warmth of our bodies could not be kept up.

(*b*) **Pure Air and Health. — 1.** Whether the blood shall carry life-giving oxygen to every part of our bodies, or whether it shall return to the lungs without absorbing the needed oxygen, will depend entirely upon the kind of air we breathe.

2. So long as the blood continues to be properly purified, or *aerated*, as it is called, in the lungs, everything goes on well; but if the air breathed be impure, then uneasiness about the chest increases to distress, is followed by headache, and may end in fainting. If we breathe very foul air, the effect is

the same as by not breathing at all, only that in the first instance death would not be caused quite so rapidly as in the second. There are few persons who have not suffered, more or less severely, in hot, crowded rooms; and, in these cases, the foul air received into the lungs is the cause of the suffering.

3. Whatever, then, deprives the lungs of pure air, sows the seeds of disease. Pure air aids in making pure blood; and pure, rich blood gives nourishment and strength to the entire body. But impure air — air that contains but little oxygen and much carbonic gas and other foul matter — makes the blood impure, starves it, and causes consumption or other diseases.

(*c*) **How Air becomes Unwholesome.** — **1.** We take into our lungs about twenty cubic inches of air at each breath; and air that has been in the lungs comes out charged with carbonic gas, and deprived of much of its oxygen. The air of a room, your school-room for instance, soon becomes impure because so many persons have breathed it one or more times. The fire in the stove, or the lamps and gas lights, are all devouring the oxygen and giving off carbonic gas even more rapidly than your lungs do.

2. Sometimes poisonous gases from sewers and cesspools find their way into our rooms through the drain-pipes; again, foul air arises from decaying vegetables in the cellar, from garbage and slops, if thrown near the house, or from stagnant pools of water. When filth from the streets or other source

is dried or pulverized, it finds its way into our apartments, and is kept circulating by our every movement. These are some of the ways in which the air of our living-rooms, sleeping-rooms, and schools may become unwholesome, and dangerous to health. We must learn to guard ourselves against this danger by careful attention to cleanliness, and by letting in the pure, fresh air.

3. Too many people seem to think there is little occasion to raise windows, except to wash them or to close the blinds; and so the lungs and skin are dried and baked in the hot, dry, unwholesome air, and people breathe, over and over, the cast-off air from each other's lungs.

4. We should not fail to caution our boys and girls against the habit of sleeping with the head under the bed-clothes, in this way breathing the breath again and again. Such unwholesome air will, assuredly, cause them to grow pale, weak, and sick. Serious disease in children before healthy has been caused by this habit, and health returned when the habit stopped.

> Better a nightcap than head under clothes;
> For, surely, no such cap e'er covered the nose!

LESSON III.

WHY WE BREATHE. — HOW TO BREATHE.

BAD EFFECTS OF ALCOHOL AND TOBACCO.

(*a*) **Why we breathe. — 1.** While food is needed to supply our bodies with material, air is needed to supply the greater amount of oxygen to purify the blood and to kindle the slow fire that warms the body.

2. The oxygen we breathe is carried to every part of the body in which blood circulates, and everywhere unites with particles and burns them, causing warmth. The product of this burning is the same as that of oil burned in a lamp, viz., carbonic gas and watery vapor; and these are sent out from the lungs. If a man is struck down by a blow, or a poison, or an apoplexy, so that he hardly breathes, his body becomes cold; the fire is almost extinguished. If he exercises, or has a fever, he breathes more rapidly than usual, and becomes heated; the fire is increased.

3. We breathe, then, that our bodies may be warm, and that the gases from the fire that keeps us warm may be cast out from the blood; in short, that we may live.

(*b*) **How to breathe. — 1.** In breathing it is best to breathe through the nose. In this way the air passes over the warm lining inside the nose, and becomes heated before it goes into the lungs.

Air should not be breathed through the mouth, as a habit, because it does not become so well warmed in that way; and cold air taken into the lungs sometimes causes colds, sore throat, and sore lungs.

2. *We should breathe sufficiently.* That is, we should draw in sufficient air, at each breath, to fill the lungs and supply the air they need. If we do not take in enough air at each breath, we must breathe oftener, and this tires the muscles that move the lungs. Besides, the air is not held long enough in the lungs to do its work, to give up its oxygen, and to take up carbonic gas.

3. *We cannot breathe properly if we wear tight clothing about the chest and waist*, nor if we stand, sit, or lie in bad positions. We should stand and sit upright, lie so that the lungs may be filled with air, and may not be pressed upon and cramped so that they cannot work. A healthy person, breathing quietly, fills his lungs about fifteen times per minute; but from bad habits of dress or posture, many people, young and old, only partly fill their lungs at each of the twenty or twenty-five short breaths they take per minute.

(*c*) **Bad Effects of Alcohol and Tobacco.**— **1.** The effect of alcohol is to thicken the delicate lining of the cells of the lungs, and this makes it difficult for the oxygen of the breath to pass through it into the blood, and for waste matter to get out. A "cold" then becomes a very serious thing, and inflammation of the lungs is very hard to cure in those

who drink much liquor. Alcohol, then, interferes with the purifying of the blood.

2. *Tobacco-smoke* irritates the lungs and does much harm. A physician says, "I lost a young man seventeen years of age, who died of lung consumption caused by smoking."

Cigarettes are more injurious than pipes or cigars. The poor tobacco of which most of them are made (sometimes soaked in opium) and the burning paper increase the bad effect.

LESSON IV.

VENTILATION AND HEATING.

(*a*) **What Ventilation is.** — **1.** The long word *ventilation* comes from the Latin word *ventus*, which means air, or wind; and to ventilate a room or place means simply to cause a change of air in it, or to cause the air to pass through it. When we can produce this much-needed change by admitting pure air from out of doors, without dangerous draught, we have good ventilation.

2. In the former lesson you were told how the air of our living-rooms, sleeping-rooms, school-rooms, etc., may become unwholesome and dangerous to health and life. Yet how often we are careless about the ventilation of these places! It is not only in the

small and crowded houses of the poor, but also in the more spacious houses of the rich that the same carelessness is seen.

3. Many people have so great dread of draughts and catching cold, that they scarcely ever open a window; and so, when we enter such houses, the air feels oppressive, smells musty and offensive, and sometimes turns us sick. Other people throw every door and window open, and the house is blown through and through by draughts of air. This, indeed, makes the air pure and fresh; but it is dangerous to health if these cold currents blow upon those in the room; but we must have some way to change the air constantly, and thus *keep* it quite pure all the time.

(*b*) **Pure Air in Bed-Rooms, etc. — 1.** In any room that does not communicate freely with the outer air we soon consume much of the oxygen; every breath we draw in such a room is injurious to health.

2. We spend about one-third of our lives in sleeping-rooms, breathing the air of them, good or bad; and some pass this large part of their lifetime in small bed-rooms with windows and doors closed, and without other arrangement to admit fresh air while they slumber. They arise in the morning feeling dull and unrefreshed, often without appetite for breakfast, and frequently with headache. Do you wonder that this is so? It is of the utmost importance that fresh air be allowed to enter our sleeping-rooms, by night

as well as by day; and this can be managed so that we shall not take colds.

(*c*) **How to ventilate.** — **1.** Men have devised many plans to ventilate rooms. Sometimes these methods are costly, and for that reason are not used. How may we ventilate our rooms when they are not supplied with patent ventilating apparatus, and when we must depend upon window ventilation?

2. To admit fresh air into our rooms, one simple and good plan is to fit boards under the lower sashes of the window raised a few inches. Air will then enter upward between the two sashes, not causing a draught upon any in the room. Another good plan is to tack a piece of cloth, a few inches wide, across the lower part of the window frame, from side to side, and then raise the lower sash not quite as high as the upper edge of the cloth. Still another is to fix an upward-sloping board across the upper part of the window-frame, six or eight inches below the top, and then lower the upper sash a few inches, but not lower than the board. In all these ways, the in-flowing air is directed upward, and there is little or no danger from draught. Any clever boy can, in these simple ways, ventilate his bed-room, the sitting-room, or his school-room.

(*d*) **Heating Rooms.** — **1.** Rooms in which we sit, our sitting-rooms, school-rooms, churches, etc., should have a warmth of 68° to 70°. Rooms in which we are required to move about or work should not be so warm. Often, through thoughtlessness,

rooms are allowed to become uncomfortably warm; and then, for instant relief, the windows and doors are thrown wide open, causing sudden and great reduction of the temperature, chill, and colds. This, too, may happen many times a day. An even warmth should be kept. The thermometer should be our guide in this, and it should be consulted frequently. If we keep our rooms too warm, we soon become very sensitive to cold air, and are chilled when we go outside, even though the air is not very cold. In this way children sometimes become so tender that their parents fear to allow them to leave the over-heated rooms, and they are thus deprived of health-giving exercise in the fresh, pure air.

2. When stoves or furnaces are used, great care should be taken that gases from the burning coal do not escape into the rooms. As a rule, they should not be filled with fresh coal while the rooms are occupied. Again, the air of rooms, to be healthy, must contain a certain amount of moisture; and as stoves and furnaces cause the air to become very dry, some means of moistening it should be employed. A shallow pan of water placed on the stove or over the heat-register will, *if properly heated*, send out vapor and moisten the air. Sometimes these water-holders do not become heated, and then are of no use.

LESSON V.

BUILDINGS. — LOCATION, CONSTRUCTION, LIGHT, ETC.

(*a*) **Where to build.**—**1.** School-houses and our homes should be built on dry ground or on ground that is well drained. If the ground is such that a cellar would be damp, it is best to build on a foundation high enough above the level to permit air to move freely underneath.

2. The ground should be made to slope in all directions from the house, so that water may run off instead of soaking in near the foundation and causing dampness.

3. Buildings should not be closely surrounded by trees, or by other buildings, on the sides where there are windows. Houses covered by vines, whose windows are choked by shrubs, and whose roofs are overhung by branches of trees, will be damp. A free circulation of air should be allowed all about the house, and shade trees so placed as to leave openings for light and sun to enter. Too much sunlight may be prevented by blinds, outside or inside. The best light is usually obtained when the corners of the house point east, west, north, and south. Such facts should be kept in mind when you build houses, and when you plant trees and shrubs about them. Slops of no kind should be thrown near the building.

(*b*) **Something about how to build.** — **1.** The material used in building school-houses should be as good as that used in the best dwellings, and the size of the rooms should be governed by the number of pupils that must occupy them. Air or breathing-space must be considered as of first importance. The best authorities say that a room 38 by 23 feet, with ceiling 12 feet high, is suited to about 40 pupils, but not more. If the space for each pupil is less than 300 cubic feet, the danger to health and life is great, unless there is good ventilation.

2. *Windows* should be placed $3\frac{1}{2}$ or 4 feet above the floor and extend nearly to the ceiling. It is best to have light enter above the level of pupils when seated. The ceiling should be white, that it may reflect the light downward; and the walls should be gray, or of a tint that will not cause a strong reflection or glare.

3. *Light* should not enter directly in front of where the pupils sit, and therefore the desks should not face the windows. The light should enter from the left, and so particular are the Germans about this, that they place windows on the left side of the room only. Eyesight is injured by exposing the eye to glaring light, and the sun should not shine directly upon the book or work. *Blackboards* situated between windows receive the light very unfavorably, and should not be placed there, if it can be avoided. If placed between windows, the inner blinds should be arranged to shut out glaring light. In short,

there should be plenty of light in every part of the room, but no eye-injuring glare. We should all learn to be very careful in managing the light, for eyesight is too often injured, little by little, in our school-rooms.

4. *Doors* should be wide and open outward. In case of fire or panic, this is very important. Transom windows over the doors are useful in ventilating, and should be provided with cords to open and close them easily. *Stairs* should be wide and of easy rise. Much stair-climbing is, for many, not good exercise.

5. *School desks* should not be placed near a heat-register or stove, against the walls, nor facing the windows. A line dropped from the edge of the desk should just strike the edge of the seat, and each pupil should be able to place his feet upon the floor, or upon a foot-shelf. Proper posture, comfort, and health demand this. When too high or too low, desks are unfit for use.

6. *Outer garments*, *wet clothing*, lunch-baskets, etc., should not be kept in the school-room. There should be a room for these, and pegs or hooks in plenty, so that the clothing may air and dry. This room should be well ventilated. A wash-stand and basin, too, should be placed here, for there is nothing more vulgar than uncleanliness and untidiness.

THE MUSCLES.

LESSON I.

WHAT MUSCLES ARE, ETC.

(*a*) **What Muscles are.** — **1.** *The muscles are the instruments of motion.* While the body owes its general form to the bones, its power of motion and its beautiful proportions are given by the muscles.

2. The *muscles* and *tendons* are to the human body what the ropes and sails are to the masts and spars of a ship. As a ship without sails and ropes would be a very unmanageable thing, so the body without muscles and tendons would have no power to move or direct its position.

3. In the bones of the body we find the *columns*, *levers*, and *pulleys* of a complex machine; and in the muscles and tendons we have the *cords*, *belts*, or *springs*, which move the bony levers and pulleys.

4. The muscles of an animal body are the *lean* meat. Lean beef, the deep-red flesh of the cow or ox, is the muscular part of the animal's body. There are more than five hundred muscles in the human body.

(*b*) **Position.** — **1.** The muscles are situated in all parts of the body. The great mass of flesh covering the skeleton is mainly composed of them, while the organs situated in the cavities of the body are either muscles, or have muscles connected with them. Among the muscles situated within the framework are the heart, the diaphragm, the muscular coat of the stomach, and the tongue.

(*c*) **Construction.** — **1.** The muscles are composed of fine *fibres* or strings held together by a connecting network of tissue, and bound up in smooth, silky casings.

2. The muscles are laid one over the other, separated by layers of fat that enable them to move without interfering with each other. These layers of fat give a plumpness of form which the body would not otherwise have.

3. In shape and in length, the muscles vary greatly. Some are round; others flat, square, or triangular. Some of the muscles of the larynx are only about one-eighth of an inch in length, while the *sartorius*, or "tailor's muscle," by which the legs are crossed, is nearly three feet in length.

4. Muscles are large and thick in the middle, but small at the ends. The middle part is called the body, or *swell*, and it possesses the power of contraction. The extremity of the muscle attached to the bone which is moved is called the *insertion*, or free end of the muscle: the extremity towards which it draws in contraction is called the *origin*, or fixed end

of the muscle. Generally the *origin* of a muscle is nearest the trunk.

5. At the ends, the threads or fibres of the muscle change into strong, tough *tendons*, of a bluish-white color, which are firmly fastened to the bones. The tendons have no power of contraction, and are merely the ropes, as it were, by which the body of the muscle is fastened to the bone, or other part, which is moved by the contraction.

6. At least one artery enters each muscle, and supplies it with blood for its nutrition. A nerve also penetrates each muscle, and connects it with that great central office of the nerves, the brain, so that it may be subject to the will.

LESSON II.

WHAT MUSCLES DO. — CLASSES.

(*a*) **How Muscles contract. — 1.** All movements of the different parts of the body are caused by the contraction of muscles.

2. The cells which compose the muscles are elastic, and have the power to widen out, making each fibre of the muscle shorter and thicker. This power of these cells is the source of the contraction of the muscles which produces all bodily movements. The contracting muscle shortens and thickens, and pulls the movable part to which it is attached with

it. A good illustration of this action is found in the work of the muscles that bend the arm. The *biceps*

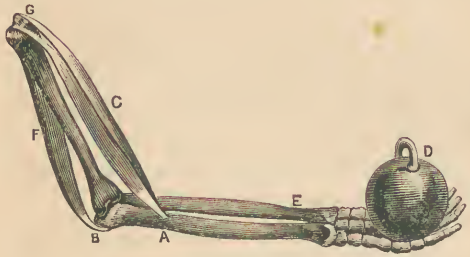

FIG. 14.

THE BONES OF THE UPPER EXTREMITY AND THE BICEPS AND TRICEPS MUSCLES.

EXPLANATION OF FIG. 14.

In this figure the biceps muscle is shown at C, and the two tendons which attach it to the shoulder are seen at G, the point of origin.

The attachment of the muscle to the radius is shown at A, the point of insertion.

The triceps muscle is represented at F, and the tendon by which it is attached to the radius is shown at B. These two muscles are *antagonistic* muscles.

muscle contracts, and pulls the bones of the lower arm upward, toward the shoulder: the *triceps* contracts, and pulls the bones of the lower arm back again, thus straightening the arm. If both of these muscles contract at the same instant, there can be no movement of the elbow-joint, and thus we see the antagonistic nature of these two muscles. Muscles which bend a joint, or move any part, are called *flexors;* those that restore the parts to their former position are called *extensors*. Figs. 15 and 16 present front and back views of the fore-arm in which the long flexors and extensors are represented.

3. More than two hundred muscles are arranged in pairs, one to draw a part in one direction, and the other to restore it to its former position, or to hold it

Fig. 15.

Explanation of Fig. 15.

f, the muscle that straightens the fingers.

h, the muscle that straightens the little finger.

i, the muscle that assists in straightening the wrist.

l, the muscle that assists in extending the fore-arm.

d, the muscle to extend the second bone of the thumb forward.

e, the muscle to extend the fore-finger.

k, the muscle to draw the little finger outward.

m, the muscle to roll or turn the fore-arm, and turn the hand.

g, the ligament which binds down the muscles at the wrist.

Explanation of Fig. 16.

a, the muscle to turn the hand inward.

b, the muscle to bend the wrist.

c, *d*, the muscles to bend the hand.

e, the muscle to assist in bending the hand.

g, the muscle to bend the thumb.

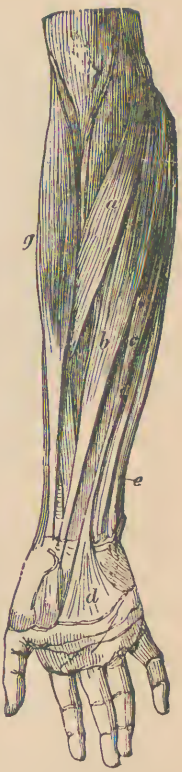

Fig. 16.

motionless at any required point in the range of its motion. These pairs are called *antagonists*.

4. All muscles do not move bones and bend joints; but some have quite different work to perform. The heart, which is a muscle, exerts its powers in forcing the blood through the arteries. The stomach and other muscles of the digestive organs exert their force in mixing, churning, and moving the food in preparing it for the nourishment of the body; and the muscles of the eye move that organ.

5. In the human face, all the various expressions that indicate the emotions of the mind — joy, sorrow, hatred, affection, pleasure, and pain — are caused by the contraction and swelling of the muscles which produce the lights and shadows of the countenance.

6. Strong bands of ligament bind down the muscles, keep them in place, and add to their strength. The muscles at the wrist and ankle are thus firmly held in place, and prevented from flying from the bones when strongly contracted.

(*b*) **Voluntary and Involuntary Muscles. — 1.** The voluntary muscles are those that are under the control of the will. They move, or cease to move, when the mind wills it. The muscles of the fingers, limbs, trunk, and many others, belong to this class.

2. The involuntary muscles are those that act independently, and are not under the control of the will. The muscles of the stomach, heart, and those that move in sneezing, coughing, and shivering as from a chill, are among the muscles of this kind.

FIG. 17.

EXPLANATION OF FIG. 17.

A closes the eye; *B* raises the eyebrows, and wrinkles the forehead; *C* raises the lower jaw; *D* closes the lips; *E* compresses the wings of the nose; *F* draws the corner of the mouth downward. Each muscle has a name given to it because of the work it performs, its shape, or size.

(*c*) **Why Muscles contract. — 1.** The muscles receive their power from the brain and nerves.

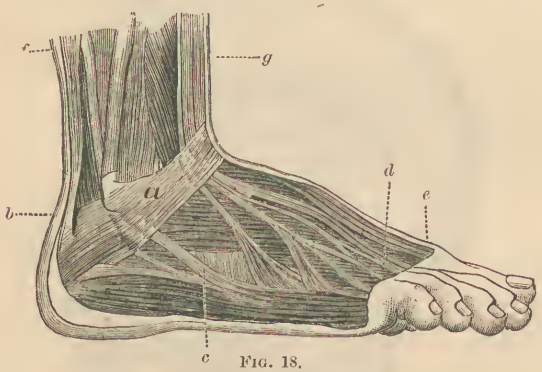

Fig. 18.

Explanation of Fig. 18.

In this figure the muscles of the lower part of the leg and of the foot are represented. Those used in extending the toes, and bending the foot upward, are situated in front of the leg and upper part of the foot; while those that bend the foot downward, and bend the toes, are located at the back of the leg and on the sole of the foot. These muscles are attached to the toes by round, cord-like tendons, that may be plainly felt, and their form seen, when the toes are extended or drawn upward.

a, the broad ligament that binds down the muscles at the ankle.

2. When the mind wills to move a muscle, the brain sends out a mysterious agent through the nerves to the cells of each fibre of that muscle, and it contracts. This is all that is known of that strange stimulus by which bodily movement is directed.

3. If a nerve be cut anywhere between the spinal cord and the muscle to which it belongs, the muscle instantly loses its power of motion.

LESSON III.

MUSCULAR EXERCISE AND HEALTH.

(*a*) **Exercise of the Muscles. — 1.** It is a general law of the body, that exercise is necessary to the health of all its parts. Tie up a blood-vessel, and it becomes a withered, useless thing. The bones become weak, and dwindle away, when deprived of exercise; and so it is with the muscles. Lack of proper exercise causes softness, weakness, and inability to perform the work for which they are designed. This is not only true of the muscles that bend the joints, and move the limbs, but also applies to those employed in breathing, and to the vocal muscles.

2. Care must be taken that exercise be not too severe, nor continued so long as to produce exhaustion: muscle is weakened, rather than strengthened, by undue exertion. Six-day walking and skating matches are not the best way to improve health and strengthen the muscles. Such over-exertion has recently caused the death of some foolish young persons who took part in them.

(*b*) **Exercise aids the Circulation. — 1.** When a muscle contracts, some of the veins are compressed, so that the blood cannot flow freely onward, and the valves of the veins forbid a backward flow. The arteries continue to force the blood along, and the veins become swollen. As soon as the contraction

of the muscle ceases, the blood rushes onward with greatly increased speed.

2. Now, when a number of muscles are employed in strong, quick action, many veins are affected in this way, and the whole circulation is quickened. The heart must work faster to send the blood to the lungs, and the lungs must work quicker to supply the oxygen required by the greater quantity of blood sent to them. The purified blood is carried back to the heart with greater speed.

(*c*) **Exercise aids Appetite and Digestion. — 1.** When the blood reaches the capillaries, the quickened flow causes them to do their work faster, and the worn-out matter is removed more quickly. The organs call for new material, and the stomach demands more food to supply new blood to the system. Thus it will be seen that muscular exercise gives vigor to every part of the body.

(*d*) **Hints about Exercise. — 1.** *Exercise should be taken in pure air;* it calls for a full supply of oxygen to satisfy the increased demand.

2. *Exercise should not be taken just before nor soon after severe mental labor, nor immediately after a hearty meal.* In this latter instance the stomach requires the blood which would thus be called away from it, and delay its work.

3. *Exercise taken during daylight is most beneficial.* It has been found that people can endure labor with much less fatigue in the sunshine than in the shade or at night, the temperature being the same.

4. *Exercise should be of a kind that will employ the largest possible number of muscles.* In order to do this, the body must take a great variety of positions, and be caused to perform many different movements to distribute the exercise to all its muscles.

5. *Exercise should be taken regularly.* It will do but little good to take exercise to-day and not again till next week or next month. *And it should be gradual*, increasing with the strength that it produces. Sudden and extreme efforts, such as lifting heavy weights to exhibit strength, should be avoided, as they not only injure the muscles, but may rupture blood-vessels and the walls of the abdomen. Many people have had reason to sorely repent foolish attempts to show great strength.

6. *The mind should be pleasantly employed while we exercise the muscles.* Exercise taken for the mere sake of exercise, or as an unpleasant task, fails to do great good. If the mind is pleasantly employed, the muscles will work long and actively without fatigue; but if the mind is gloomy or inactive, the muscles soon grow tired. You have already learned, from experience, how irksome any work is in which you are not interested and do not find pleasure.

(*e*) **Kinds of Exercise.** — **1.** *Walking* is an excellent exercise to develop and strengthen the muscles of the lower part of the body. The trunk should be kept erect, the shoulders back, and the head up, in this way allowing full breathing. Shoes should be easy and broad enough to give the foot free play.

Many people are prevented from taking this kind of exercise because of the shoes that hurt the feet.

2. *Running* being really a succession of slight leaps, is a more vigorous exercise than walking, and brings into play a larger number of muscles. When moderately practised it strengthens the power of the lungs.

3. *Swimming* exercises a very large number of muscles of the limbs, chest, and abdomen. Probably no one form of exercise employs more of the muscles. When not indulged in too long or at an improper time, swimming is a most strengthening exercise. Besides, it is a safeguard to life.

4. *Rowing* employs the muscles of the arms and back principally. Without care is taken, it may cause round shoulders and hollow chests. It is best to bring the trunk to an erect position when rowing is practised as a means to health.

5. *Gymnastics* and the use of light dumb-bells bring into play a great variety of muscles. The latter exercise the musele of the trunk and arms, and develop the chest. Our girls as well as our boys should have proper exercise. And for the more especial object of strengthening the arms, muscles of the shoulders and the chest, and increasing its capacity, a pair of very light dumb-bells may be used, but never so long as to weary the arms. If dumb-bells are not to be had, a pound or two-pound weight in each hand, throwing them backward and forward, in the same way as the dumb-bells, will give the same exercise.

6. *In all forms of exercise the clothing should be sufficiently loose* to permit free movement of the muscles, limbs, and body generally. Clothing which interferes with free movements should not be worn at any time.

(*e*) **Alcohol and the Muscles.**—Alcohol benumbs the nerves, and then they cannot direct and control the muscles. Movements then become very uncertain. When a man has drunk much liquor, he staggers and reels because he cannot control his muscles. In course of time his nerves would be so much injured that they could not control his muscles very well, even when he was sober. He would tremble, and could not use his hands so exactly as he should. He would have to give up delicate work that requires a steady hand and nice touch. But alcohol does more than this. It weakens muscle by changing it into fat. Muscle then becomes soft, feeble, and easily torn. If it is a muscle in a blood-vessel of the brain, it may, and often does, break; then the blood pours out through the torn vessel, and causes death by apoplexy.

THE BRAIN AND NERVES.

LESSON I.

THE BRAIN AND ITS WORK.

(*a*) **Position.** — **1.** The *brain*, the principal organ of intelligence, is situated in the head, and is surrounded and protected by the bones of the skull.

Fig. 19.

Explanation of Fig. 19.

This figure represents the left half of the brain. — *CE*, the *cerebrum*; *CER*, the *cerebellum*; *MO*, the *medulla oblongata*; *OP*, *optic nerve*; *SC*, *spinal cord*.

2. The brain is divided into two parts. That which occupies the cavity of the skull above the level of the ears is called the *cerebrum*, or *great brain:* the part which fills the cavity below the level of the ears, at the back of the head, is called the *cerebellum*, or *little brain.* A membrane, tightly stretched, separates the two parts, and relieves the lower brain from the weight and pressure of the upper one.

(*b*) **Construction.—1.** When the bones are removed, a thick, shining membrane is seen. This is the *dura mater*, or firm coat of the brain, and its office is to assist in keeping the brain together, and to protect it. Beneath the outer coat lies the *arachnoides*, or transparent coat, which is a very delicate, transparent membrane. It so much resembles a spider's web, that it receives its name from that fact, —*arachnoides*, "the spider's web." This membrane lies over the surface of the brain. The third and inner coat is called the *pia mater*, or soft coat. It is a thin network of blood-vessels.

2. The substance of the brain consists of two kinds of matter; viz., *gray* and *white.* The gray matter forms the outside of the brain, and the white the inner portions. So extremely soft is the substance of the brain, that it would fall apart from its own weight if it were not surrounded by its membranes. The outer surface of the brain is not smooth and regular, but consists of worm-like ridges interspersed with hollows; in other words, it is furrowed.

(*c*) **Work of the Brain.—1.** The brain is the

seat of thought, of intelligence, of sensation, and of motion. It is there that we think, reason, and will.

2. It is believed that the *cerebrum* is the chief organ of the mind, the thinking part. Various kinds of work have been attributed to the *cerebellum*. Experiments seem to prove, that, if the *cerebellum* be injured or removed, a confusion of movement of the muscles is caused, like that produced by alcoholic intoxication. It is believed, therefore, that this organ is the regulator of muscular motion.

LESSON II.

THE NERVES AND THEIR OFFICE.

(*a*) **Location of the Nerves.** — **1.** *Nerves* spring from the brain and spinal cord, and extend to every part of the body.

2. Certain nerves start from the base of the brain, within the skull, and extend to the eye, ear, tongue, nose, throat, stomach, heart, etc. These are named *cranial* nerves, because they begin in the *cranium* or skull.

3. The *spinal cord*, which is an extension of the substance of the brain, extends downward through the tube or canal of the backbone. Between the points of the bones of the spine, the spinal cord sends out branches, which are named *spinal nerves*. These extend to the arms, the chest, the abdomen, the legs, etc., and have various names.

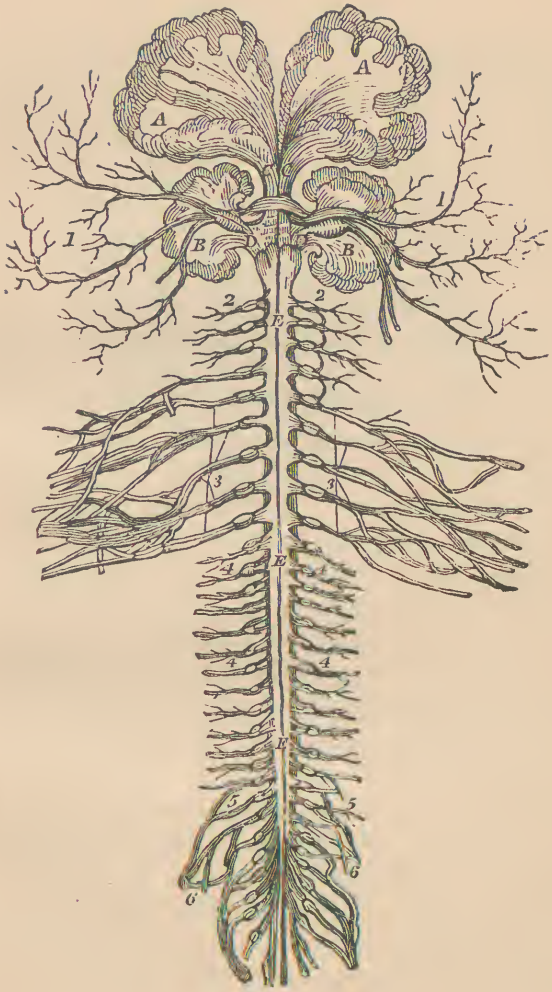

Fig. 20.

Explanation of Fig. 20.

A, *A*, the *cerebrum*.

B, *B*, the *cerebellum*.

C, *C*, the union of the fibres of the cerebrum.

D, *D*, the union of the fibres of the two sides of the cerebellum.

E, *E*, *E*, the spinal cord.

1, *1*, the cranial nerves.

2, *2*, the branches of the spinal nerves that extend to the neck and organs of the chest.

3, *3*, the branches of the spinal nerves that extend to the arms and fingers.

4, *4*, *4*, *4*, the dorsal nerves that extend to the walls of the chest, back, loins, and abdomen.

5, *5*, the lumbar nerves that also extend to the chest and abdomen.

6, *6*, the sacral nerves that unite, and form the great sciatic nerve of the legs.

4. The nerves branch out from the spinal cord precisely like the limbs and smaller branches of a tree.

(*b*) **Construction. — 1.** The nerves branch off in pairs from the brain and spinal marrow, through little openings in the bones. Twelve of these pairs spring directly from the brain, and thirty of them from the spinal cord, sending their branches and twigs to every muscle, blood-vessel, or other organ of the body. The nerves, although so widely distributed through the body, have a tendency toward the surface, and countless numbers of twigs, so small as to be invisible to the naked eye, terminate under the skin: hence the skin is the principal organ of touch. The brain, spinal cord, and nerves constitute the *nervous system*.

Work. — 1. The nervous system has distinct offices to perform. While one portion (the brain) is engaged in thinking, and in receiving pleasant or painful sensations, or in sending out its commands to the body, another portion (the nerves) is engaged in conveying information and in carrying orders to the different organs.

2. The nerves are divided into two classes; viz., the *sensory* nerves and the *motor* nerves. The sensory nerves are connected with the organs of taste, smell, hearing, sight, and touch. They carry impres-

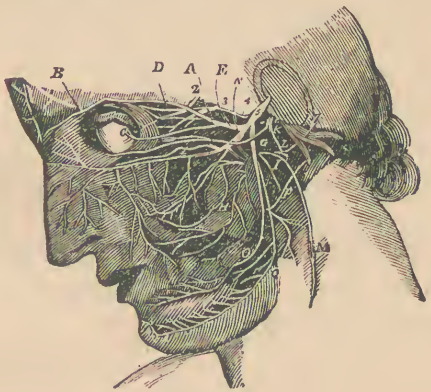

FIG. 21.

EXPLANATION OF FIG. 21.

2, the *optic nerve*, nerve of sight connected with the eyeballs.

3, the *motor oculi*, used to move the eyes.

4, the *trochlearis*, which rolls the eye downward.

5, the *tri-gemini*, whose three branches extend to the upper part of the face, to the upper jaw and teeth, to the lower jaw and teeth (this nerve is affected in toothache), to the tear-gland of the eye, and to the nose.

O, the nerve of the tongue and of taste.

P, a branch of the nerve of taste, going to the ear.

Q, the nerve of the teeth of the under jaw, which finally comes out on the chin to supply the muscles of expression.

7, the *auditory nerve*, being the nerve of hearing.

sions to the mind of the effects produced upon them in these organs. The *motor* nerves are connected with the muscles. When the brain wills that a muscle shall move, a message with power is sent to that

muscle through its *motor* nerve, and it moves. Thus every muscle is moved by a *nerve of motion*, while beside it, in the same sheath, is the *nerve of sensation*. If the mind wills that a finger be placed on anything, the *motor* nerve moves the muscles of the finger, and the *sensory* nerve instantly reports to the brain whether that thing is cold or hot, rough or smooth. So when we smell, taste, or see anything, or hear a sound, the nerves of sensation tell the brain whether it is sweet or sour, red or white, loud or low, etc.

The nervous system is like a great telegraphic system. If a nerve or a wire be severed, communication instantly ceases.

LESSON III.

LAWS OF HEALTH OF THE BRAIN AND NERVES.

1. *Healthful food, a clean skin, and daily exercise* in the open, pure air, are, first of all, necessary, if we would have healthy brains and strong nerves.

2. *Have regular hours for work and for amusement;* and let there be variety, else one set of nerves will be wearied by too much action, and another set be unemployed when they should have exercise.

3. *Loss of sleep weakens the brain and nerves.* Take seven or eight hours sleep by night; and go to bed at the same hour, as a habit. When wearied by

hard brain-work, by care, or sorrow, sleep as much as you can. Sleep is "tired Nature's sweet restorer"; and during it, the brain and nerves recover strength. The brain, when excited, as much needs rest as a broken limb or an inflamed eye; and sleep is one of the best cures for severe headache. Care should be taken that the pillow is not so soft that the head sinks into it and becomes overheated, as this may cause headache.

4. Hard study at night before going to bed excites the brain and delays sleep. An hour's study in the morning is worth two at night.

(*a*) **Alcohol and the Brain and Nerves.—1.** The brain is greatly injured by alcohol. It causes the blood-vessels there to become crowded with blood. Such pressure may cause them to burst, and then death would be very sudden. Continual use of alcohol sometimes causes softening of the brain and insanity.

2. When it touches the nerves it benumbs them and unfits them for their work. When the stomach becomes diseased, the brain inflamed, and the nerves injured by alcohol, drunkard's craziness or *delirium tremens* sometimes sets in. One who has this disease cannot sleep. He trembles from head to foot and becomes wild. He imagines that snakes and other horrible creatures are about him. The delirium may continue till he sinks exhausted and dies.

3. The most serious effect that alcohol produces is to destroy the power of the *will*. The drinker loses

control of himself. He cannot stop drinking and will do almost anything to obtain liquor. His mind becomes weak, and he is careless about his good name. He neglects his business and loses his property. It leads him to be dishonest and to commit crime. Volumes might be filled with accounts of terrible deeds done by people whose brains have been injured by drinking. Only the other day a young lad shot down two innocent men while his brain was wild from drink. Thus you see that it is terribly dangerous to tamper with liquor.

(*b*) **Opium and Tobacco.** — **1.** In many of its effects opium is like alcohol. It injures the brain and nerves and destroys self-control. Those who are so foolish as to meddle with it soon become slaves to it, and are almost crazed when they cannot get their regular dose. When the usual dose has been withheld, the users have become crazed, and have died in a few days. Its effects are even worse than those of alcohol.

2. *Tobacco* is also a brain poison. It injures the brain and weakens the nerves. When much used it causes a loss of memory. It makes many who use it peevish and dissatisfied when for any reason they are without it for a short time. Like the other narcotics, appetite for it grows stronger constantly, and the more the appetite is satisfied, the worse is the tobacco-user's condition.

THE SPECIAL SENSES.

THE EYE.

LESSON I.

THE EYE, AND HOW WE SEE.

(*a*) **Position.**—The *eye*, the organ of sight, is situated in the upper part of the front of the skull, in hollows of the bones. It is surrounded, and protected from blows and accidents, by the bones of the socket in which it is placed.

(*b*) **Construction.** — **1.** The eyeball has three coats; viz., the *sclerotic* or outer coat; the *choroid* or middle coat, and the *retina* or inmost coat. These coats lie one within another, like the layers of an onion, and hold the humors in globular shape.

2. The *sclerotic* (that is, *hard*) coat, like the dura mater of the brain, is thick, strong, and not sensitive. It has an opening in front, in which the cornea is placed. This coat gives great security to the delicate portions of the eye, and affords attachment to the muscles. The *choroid* coat (*choroides*, fleecy) is very fleecy and soft, and is filled with minute arteries and veins, which form a web about the eye.

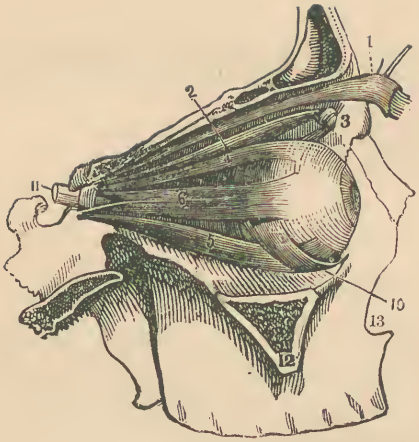

Fig. 22.

Explanation of Fig. 22.

To the outer surface of the sclerotic coat are attached six muscles. Four of these are called *straight* muscles, two of which roll the eye upward and downward: the other two give it a sidewise motion to the right and left. The remaining two are called *oblique* muscles, and serve to roll the eye inward and downward.

1, the muscle which raises the upper lid.

2, the superior oblique muscle.

3, the pulley through which its tendon plays.

4, 5, 6, straight muscles.

10, inferior oblique muscle.

11, the optic nerve (nerve of sight).

12, cut surface of cheek-bone.

13, opening of the nose, or nasal orifice.

The *retina* (that is, *a net*) resembles ground glass in color, and is so very delicate that it cannot bear its own weight. It is really an extension and expansion of the optic nerve. It receives the rays of light, and is the immediate seat of sight.

3. The *cornea* (*cornu*, a horn) covers the front of the eye and aqueous humor. In form and appearance it resembles a watch-crystal. It is composed of thin, transparent plates.

4. The *iris* (that is, *the rainbow*) is that portion of the middle coat of the eye which lies back of the cornea. The coloring-matter of the eye is spread over its inner surface, black, blue, or brown, as the case may be. In the iris is a circular opening called the *pupil* of the eye. The iris has the power of expanding and contracting, and thus enlarges or diminishes the size of the pupil (*pupilla*, a little puppet).

5. The *crystalline lens*, the "magnifying glass" of the eye, is found between the two humors, just back of the pupil. It resembles a circular glass button, convex on both sides. It is held in place by a delicate, transparent envelope, which connects it with the coats. It focuses the rays of light.

6. The *aqueous humor* lies directly back of the cornea, and fills the front chamber of the eye. It is a perfectly clear, water-like fluid (*aqueous*, like water). It sustains the cornea, and keeps it always at the same distance from the pupil of the eye. The *vitreous humor* (*vitreous*, glassy) occupies the back

chamber of the eye. It consists of a substance like the uncooked "white" of an egg, which is transparent, and allows light to pass through it to the retina.

7. The *optic nerve* springs from the brain, passes through a bony canal, enters the back of the eye, and branches off through the globe. The small fibres of the nerve within the ball assume the form of a web, and constitute the retina. It is about three-fourths of an inch long, and somewhat larger than a straw.

8. The *lachrymal gland* (*lachryma*, a tear), is a small sac in the upper and outer socket of the eye, just above the ball. It prepares the tears and constantly pours out enough of its contents, by pressure of the lids and rolling of the eye, to moisten the surface of the eye, and prevent shrivelling. The tears finally find their way to the inner corner of the eye, and there enter little openings (*lachrymal canals*), from which they flow into a bony tube (*nasal canal*), and thence into the nose, whose inner surface they moisten.

EXPLANATION OF FIG. 23.

a, the *lachrymal*, or *tear-gland*, lying beneath the upper eyelid.

b, *b*, the situation of the openings through which the tears flow into the tubes that convey them into the nasal sack and duct.

c, *c*, the tubes continued from the openings.

d, the nasal sack.

e, the nasal duct, continued from the nasal sack.

f, little canals that convey the tears to the eye from the gland.

FIG. 23.

How we see. — 1. As yet, no one has been able to explain precisely *how* or *why* we see.

2. We know that light is reflected from objects; that it enters the eye through the transparent cornea, passes through the aqueous humor, and enters the pupil; that it passes through the pupil, and reaches the crystalline lens, where its rays are bent from a direct course. After the rays reach the retina, a picture of the object is formed upon it, and the impression is conveyed by the optic nerve to the brain, where it is understood or *seen*, but *how*, we do not know.

3. The iris expands and contracts independently of the will. When the quantity of light is too great, it contracts, diminishes the size of the hole in its centre, and shuts out some of the rays. When we leave a well-lighted room, and enter another where there is less light, the iris expands, and enlarges the pupil, in order to admit as many rays as possible.

LESSON II.

CARE OF THE EYE. — ABUSE. — DISEASE.

(*a*) **Care of the Eye. — 1.** Care should be taken, in working or reading by lamp or gas light, *that the rays do not strike the eye directly.* The light should fall upon the work or the book, and not upon the eye. Allow the light to fall from above the level of the eye, or over the left shoulder, but *do not face it.*

2. The nerves and muscles of the eye become fatigued by long-continued work, and may become *permanently weakened by lack of rest.* Care should be taken to give them a few minutes' rest occasionally, when they are employed in reading fine print, sewing, etc.

3. In all instances, try to have plenty of clear, steady light, especially when you read, write, draw, sew, or in any work that is "trying to the eyes"; and give the eyes rest for a short time occasionally, by looking away from the work at more distant objects. Do not continue the work so long as to tire the eyes, as this weakens them, and will cause a loss of good eyesight. When the eyes are used so steadily that the sight begins to blur, the danger-point is more than reached.

4. Avoid all glaring light. The sun should not shine directly upon your work; and, when you read, study, sew, etc., at night, use a shaded lamp.

5. Close use of the eyes by twilight or in a dimly lighted room is very injurious. Fine work, and that upon dark surfaces, such as sewing dark or black cloth, etc., should be done by daylight.

6. We should not make a habit of reading while walking or riding. The eye and its muscles are strained in trying to follow the unsteady print. We should not read when lying down; for the book cannot easily be held in proper position, and, in the endeavor to accommodate itself, the eye is overstrained, and its muscles weakened.

7. In reading, many children hold the book nearer to the eyes than is necessary, or, by bending over their work, bring the eyes too near it. These habits injure the eyes, and, if they are not already near-sighted, may cause them to become so.

(*b*) **Near-sightedness.** — **1.** Near-sightedness is a very common disorder of the eye; and you would be surprised to know how many children, in every school, are more or less near-sighted. Much of it is caused, doubtless, by using the eyes in deficient light, and bending the head over, so as to bring the eyes close to objects, as in reading, writing, etc.

2. Great care should be taken in our schools, both by pupils and teachers, to secure good light, and to avoid a habit that may cause near-sightedness. While concave glasses relieve this disorder, proper care may avoid it altogether.

(*c*) **Far-sightedness.** — People who are far-sighted cannot see near objects distinctly. In reading, they hold a book at arm's length in the effort to see distinctly. Far-sighted children may acquire a squint in trying to see things near by. Convex glasses give relief in this disorder of the eyes.

(*d*) **Color-blindness.** — People who are "color-blind" are unable to distinguish the difference between certain colors. Red and green are the two colors which the color-blind are least able to distinguish. Seeing a plant at a distance, they cannot detect the difference between the red flower and the green leaves; or, seeing two colored lights, one red

and the other green, they cannot tell which is red or which green. Children should be taught early to attend to colors, as this sense may be improved by training.

(*e*) **The Use and Selection of Glasses. — 1.** Many people think that the use of glasses, when really needed, can be safely postponed. This is an error. For near-sighted children to keep up their school-work without the aid of proper glasses is to make them more near-sighted, and also to increase the danger of other diseases of the eye. People are often misled by the belief that defects of sight can be corrected without the use of glasses; and they try so-called "cures" that do much harm. Many defects cannot be cured, but only relieved; and the good effects of the use of proper glasses in near-sight and far-sight cannot be overestimated.

2. Caution should be used in selecting glasses. The selection of proper glasses should be entrusted only to those who, by study and experience, have obtained a knowledge of safely correcting poor eyesight by the use of glasses. It is unwise and dangerous to entrust the selection to travelling pedlars and quack doctors, who do not understand our defects of sight; and it is just as unwise to think that we can, unaided, make a proper choice. Glasses must be accurate in their measurements and curves, be properly framed, and free from imperfections. Many of the glasses commonly sold are unfit for use. Glasses that do not give complete ease and relief to

the eyes are an injury and not a benefit. But, when good glasses should be worn, do it; for your eyesight is of much more importance than mere "looks."

(*f*) **Size of Type and Tint of Paper. — 1.** The size of the type in books should be such that young children need never hold a book nearer than ten inches, and adults never farther than eighteen inches, from the eyes. As soon as perfectly distinct sight cannot be obtained and maintained at these distances, glasses should be used. The finer the type the closer the book has to be brought to the eyes, and in this way the eye and its muscles are strained. The long-continued use of the eyes upon objects brought close to them is one of the most fertile causes of near-sightedness. Again, too coarse print with a wide page requires undue exertion of the muscles that move the eye from side to side, and is apt to cause confusion in finding the next succeeding line, thus proving wearisome to the eye.

2. The tint of the paper has an influence upon the ease with which we see in reading. It is important that there be no dazzling glare of the page, and for this reason pure white paper, such as is commonly used, or paper that has a gloss and bluish tinge, should not be employed. It has been found that a very light yellow tinge, like that of unbleached muslin, is best for the eyes.

(*g*) **Diseases of the Eyes, etc. — 1.** Whenever your eyes become diseased, have them treated immediately by your doctor or by another whom he

recommends. Never tamper with homemade cures, for the eye is too delicate and precious to be trifled with by unskilful persons.

2. In diseases of the eye in which matter forms, care should be taken to prevent matter from the diseased eye getting into the well one. All articles used in cleansing the eyes should be destroyed by burning, particularly the cloths and sponges. Towels and handkerchiefs used in case of sore eyes should not be washed among other articles, and it is dangerous to use the same towel and basin used by one who has sore eyes.

3. Cinders, or other small atoms, may be safely and easily removed from the eye by a small camel's-hair brush dipped in water and passed over the eyeball, on raising the lid. When lime gets into the eye, very serious injury may be prevented by at once bathing the eye with a little weak vinegar and water, which must be applied to the eyeball itself, between the lids, and any little particle of lime be carefully removed with a feather or camel's-hair brush.

(*h*) **Tobacco-Smoking.** — Smoking, in the extreme degree, causes dilation of the pupil of the eye, confusion of sight, bright lines, cobweb specks, etc. (*Richardson.*) The cigarette affords the most injurious kind of smoking. More of the hot smoke finds its way into the air-passages, and more of the acids and alkalies come in contact with the delicate linings of these and of the mouth, and enter the blood, than in pipe or cigar smoking.

THE EAR.

LESSON III.

THE EAR, AND HOW WE HEAR.

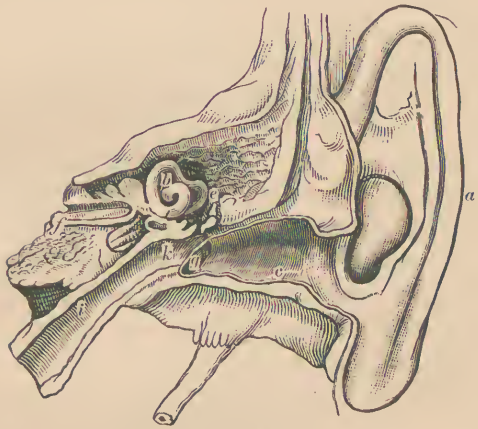

FIG. 24.

EXPLANATION OF FIG. 24.

a, the external ear.
b, the canals of the labyrinth.
c, the auditory canal.
e, the anvil-bone.
f, the cochlea.
g, the tympanic membrane.
k, the middle ear (*tympanum*), in which the little bones are placed.
i, the Eustachian tube.

(*a*) **Location.** — The *ear*, the organ of hearing, consists of three parts; viz., the *external* ear, the *middle* ear, and the *internal* ear. The external ear is on the outside of the head, and the middle and internal portions are in the bones, at the base of the skull.

(*b*) **Construction.** — **1.** The *external* ear is a thin, elastic cartilage, concave on one surface, and convex on the other. Its concave surface consists of grooves which finally form one large basin at the entrance of the opening into the head. From the opening, a passage or tube, called the *auditory canal*, extends to the middle ear, or *drum*. This canal is about an inch in length, and its inner end is closed by a thin, tightly drawn membrane, called the *tympanic membrane*.

2. The *middle* ear (*tympanum*), or drum, is a small cavity which is separated from the auditory canal by the tympanic membrane. The air within the drum communicates with the outside air by a passage called the *Eustachian tube*, which leads to the back part of the throat. Within the drum is a collection of four small bones, one joined to the extremity of another. From their shape, they have been named the *mallet*, the *anvil*, the *stirrup*, the *round bone*. Fig. 25 represents these bones in their natural size, excepting the last one, which is magnified.

Fig. 25.

3. The *internal ear*, or *labyrinth*, consists of winding passages in the solid bone. The *auditory nerve* is spread over these passages like a lining, and they are filled with a watery liquid. One of these winding passages is named the *cochlea*, or snail-shell.

(*c*) **How we hear.** — **1.** All things which produce sound vibrate in doing so, and communicate

these quiverings to the air around them. The waves of air reach the external ear, which, like a funnel, receives as many of them as it can, and causes them to flow along its channels into the auditory canal.

2. The air-waves beat upon the membrane of the drum, and cause it to vibrate just as the head of an ordinary drum does when it is struck. The vibrations of the membrane cause the air within the drum (*tympanum*) to vibrate, and to set the little bones to vibrating and swinging, at the same rate. All these shakes and vibrations produce similar ones in the watery liquid in the labyrinth, and these produce some kind of an impression on the *auditory nerve*, which lines the inner ear. This nerve carries the sensation to the brain, which recognizes it, we know not how, as *a sound*, and we *hear*.

LESSON IV.

CARE OF THE EAR.—INJURY TO HEARING.

1. Draughts of air from open windows, especially when riding in swift-moving cars, may chill the ear and cause inflammation and earache.

2. In bathing in cold water, care should be taken not to allow the water to enter the ears, as it chills and injures the sensitive membrane. Again, the weight and pressure of the water upon the drum-head injures it. If water gets into the ears, care should be taken to remove it, and this may be done

by holding the head over, sidewise, and then hopping on the foot on the same side, if necessary.

3. Diving from a height without having the ears plugged, to prevent the sudden entrance and shock of the water, may cause deafness.

4. Blows upon the ears — boxing the ears with the hand or with a book, etc. — cause concussion that injures the internal ear, and may cause the loss of hearing. The ears are not intended to be boxed. It would be as wise to poke one's finger into an eye, to inflict punishment, as to strike a blow upon the ear.

5. The firing of cannon and other loud sounds made close to the ear may cause lasting deafness. Gunners open their mouths, and in this way relieve the ears from shock that would otherwise injure them. The dangerous trick of clashing stones together while bathing with the head under water causes an almost deafening sound, injures the ear, and impairs the hearing.

6. The smoking of tobacco, and the habit of breathing through the mouth, both injure the ear and hearing by making the delicate mucous lining of the air-passage leading into the ear from the back chamber of the mouth dry.

7. Ear-wax keeps the lining of the tube of the ear soft and pliable. When it becomes dry, the wax usually falls out in the form of thin flakes or scales. Sometimes it forms in hard lumps, stops the opening, and interferes with hearing. It may then be re-

moved by gently syringing the ear with warm water, but never by scraping the ear with pin-heads, pen-holders, match-ends, ear-picks, etc. These scraping things injure the lining, and may rupture the drum-head and cause deafness. Besides, instead of removing the wax, they sometimes pack it against the drum, and thus injure hearing.

8. If an insect gets into the ear, it may be killed by pouring in a few drops of sweet oil, and then removed by gently syringing the ear with warm water. If this does not remove the insect, do not probe the ear, but go to your doctor, and let him remove the intruder.

9. Children sometimes poke peas or beans into their ears. In this case no syringing with water or any other liquid should be resorted to, as it would cause the pea or bean to swell and become firmly lodged. Dry heat alone must be employed. The doctor should be sought immediately. If, however, a hard body, such as a button or bead, be pushed into the ear, syringing may bring it out. The head should be laid over so that the ear in which the button or bead is be undermost, and in this position the water may be thrown up; but the nozzle of the syringe must not enter the ear, for it may prevent the article from dropping out.

THE SKIN.

LESSON V.

THE SKIN. — SENSE OF TOUCH.

(*a*) **Location.** — The *skin* is the outer covering, or envelope, of the body.

(*b*) **Structure.** — **1.** The skin consists of two layers, viz., the outer, or *scarf skin*, and the inner, or *true skin*.

2. The *scarf skin* consists of layers of flat, transparent scales, which are constantly being cast off and renewed. The dandruff of the head, and the white scurf that deposits itself on the clothing, are portions of the worn-out scarf skin. This part of the skin has neither nerves nor blood-vessels, and, when cut or punctured, suffers no pain. It is very thick over those parts of the body that are exposed to friction in working. This is especially true of the palm of the hand and sole of the foot.

3. The *true skin* is a dense, thick membrane, consisting of strong fibres that are arranged like those of felt cloth. This part of the skin is filled with small blood-vessels, which give it a bright-pink color. Besides the blood-vessels, the true skin contains *nerves*, *lymphatic-tubes*, *oil-tubes*, and *perspiration-tubes*.

4. The *arteries*, *veins*, and *capillaries* branch out all over the skin in a fine network. The *nerves* are so numerous that a needle cannot pierce the skin

without touching one of them. The *lymphatics* are little tubes which open outwardly, on the under surface of the scarf skin, while inwardly they connect with the veins. The *oil-tubes* are very abundant. Their mouths open upon the outer surface of the skin, and may be plainly seen at the edges of the eyelids and about the nose.

(*c*) **Work of the Skin.** — **1.** The skin, being tough and elastic, protects the tender flesh from injury. It also serves as an outlet for much of the worn-out or waste matter of the body, some of which is carbonic acid, some of an oily nature, and much of it perspiration.

2. The *perspiration-tubes* gather up, from the capillaries, waste matter in the form of water, salts, acids, etc., and carry it to the surface of the skin. The little mouths of these tubes are so numerous, that more than three thousand of them have been counted in one square inch of the skin. The work of these tubes goes on constantly. When their action is much hastened, they pour out the perspiration in so large a quantity that it may be seen on the skin, and this is called *sensible perspiration.* When the tubes do not discharge so rapidly as to cause the fluid to be seen on the skin, it is called *insensible perspiration.*

3. The *oil-tubes* (*sebaceous glands*) carry an oily substance from the blood, which, passing out over the surface of the skin, keeps it from becoming hard and dry, and also affords a natural oil, or dressing, for

the hair. The mouths of these little tubes, upon the forehead and about the nose, are liable to become closed with hardened sebaceous matter, which appears as small, black dots, improperly called "skin-worms."

4. The *lymphatics* absorb certain substances with which the skin may come in contact, carrying them into the blood-vessels. It is known that the body absorbs water through the skin, and that many drugs when applied to tender parts of the skin produce the same effects as when taken into the stomach.

5. The *nails and hair* are outgrowths from the skin. The nails protect the ends of the fingers, enable us to pick up small objects, and assist the sense of touch. The hair of the head protects the brain from extremes of heat and cold; the eyebrows prevent perspiration from running into the eyes; the eyelashes, and hairs of the nose and ears, are a protection from dust, insects, etc.

6. The *coloring-matter* is spread over the true skin, and this gives the variety of complexion noticed in different people and in the various races of men.

7. The *skin regulates the warmth of our bodies.* When from any cause the body becomes too warm, the pores of the skin open wider, and the blood flows more freely to the surface of the body. The sweat immediately appears, and the loss of heat caused by its change into vapor cools the skin and the blood that flows through it; and thus the warmth of the body is kept from becoming too great. But when

the body is exposed to cold, the pores of the skin close, and the perspiration does not pass off so freely. The skin remains dry, and this helps to keep the body as warm as it should be.

8. The *sense of touch* belongs particularly to the skin. Many portions of our bodies are quite insensible to touch, and, except when diseased, are nearly destitute of feeling, having but few nerves. The skin is not everywhere equally sensitive to the touch. The tips of the fingers have a very large number of nerves, and for this reason they are especially employed in finding out whether things are rough or smooth, hot or cold, and in aiding the eyes to form correct impressions of the size and shape of objects.

9. The sense of touch is very keen in the blind, and they become accustomed to obtain much of their knowledge of the outside world by it. Very recently a lad fifteen years of age, and blind from birth, had an operation performed on his eyes, and received sight. At first his sight was of no use to him, for he could not recognize the most familiar objects until he could touch them. He did not know a key from a book by the sense of sight alone, until he became familiar with the difference by both seeing and touching them.

LESSON VI.

THE SKIN AND HEALTH.—BATHING.

(*a*) **Closed Pores cause Disease.—1.** Learned men, by curious experiments, have found that the skin casts out more waste matter from the body than any of the other organs do. If, then, the skin has its perspiration-tubes closed up by chill, or by allowing them to become varnished over by the matter which they carry out from the blood, the poisonous particles that should be thrown out by them must be cast out either by the lungs, kidneys, or bowels.

2. When these organs are strong and healthy, they may bear this extra labor for a time, without being greatly injured; and still they become, little by little, weakened by this extra task. If the lungs, kidneys, or bowels are not very strong, they will be unable to take up and empty out all of this impure matter from the blood. The air-vessels of the lungs may become clogged and inflamed by it, or it may cause inflammation of the bowels and kidneys. We have learned that the skin regulates the warmth of the body. If the pores become closed, the heat of the body will be much increased, and we shall have "fever." If we would have good health, we must keep the skin clean and its pores open by proper bathing, clothing, and warmth.

(*b*) **Bathing.—1.** In summer time or warm weather, bathing, as a means of cleansing the skin, should be practised two or three times a week, or

oftener. It is not best to bathe before breakfast, or just before or just after a hearty meal, nor when tired and overheated. About midway between meals, or before going to bed, is a suitable time for most persons.

2. Bathing must not be entered on or persisted in carelessly, or it may do great mischief. If the bather do not feel a glow of warmth after leaving the water, or if he have a headache, or feel languid or chilly, then he may be sure the bath has been taken at an improper time or in an improper way, and that it has not done him good.

3. Care should be taken as regards the temperature of the water in which we bathe. Hot-water baths, while more cleansing than cold water, are more weakening. Once a week is often enough to use a hot bath for cleanliness. It should be borne in mind, that on leaving a warm bath, the person should not expose himself to a current of cold air, which, by checking the action of the perspiration-tubes and closing the pores, will cause "cold," or inflammation.

4. "A 'cold bath' is not necessarily a bath in water of the temperature of the air. A bath is truly and really cold when it causes a slight, momentary shock, followed by a pleasant return of warmth. This effect for most people is obtained by bathing in water of about 65° or 70° warmth. Bearing this in mind, we can enjoy our 'cold' bath as safely and pleasantly at Christmas as at midsummer, and there is no occasion for the most timid or weakly to give

up his bath because the summer weather is over. When the water is colder than 60°, let it be heated to about that degree, and we shall still have our cold bath. To bathe in unwarmed water, all the year round, whatever the temperature of the water may be, is uncalled for and unwise."

5. Whatever the kind of bath, the body should be rubbed with a hard towel till a gentle glow is felt, and then polished with a brush. This will soon not only be easily borne, but will afford pleasure. Sponging the chest and arms on arising is a very good substitute for a bath.

6. Soap may be used to assist in removing oily matter from the skin, but care must be taken not to use very strong soap, in which there is much alkali, lest it remove the oil so completely as to leave the skin too dry, in which case it would become chapped and rough. Finally, the bath should not be indulged too long. Young people sometimes remain in the water from half an hour to an hour. This is injurious. Ten to fifteen minutes is long enough to secure all the good from a bath.

LESSON VII.

CLOTHING AND HEALTH.

(*a*) **Quantity of Clothing.** — **1.** The object of clothing, in its relation to health, is to protect the body from too sudden change of temperature, and to

aid the skin in regulating the warmth of the body. We may wear clothing that keeps the body too warm and causes the perspiration to flow too freely. This causes the skin to become very sensitive to slight changes in the temperature of the air. Again, we may be too thinly clothed, and thus permit the warmth of our bodies to pass out too freely, causing a chill and closing the pores of the skin. We should try to avoid both of these extremes.

2. There can be no exact rule given for the quantity of clothing. It must be regulated to suit our habits, health, and exposure, and should be sufficient to keep the body *comfortably* warm. It is best that the amount worn should vary with the weather, and be increased or diminished with the temperature of the air.

3. When the appetite for food becomes poor and we eat but little, or when the food is not good and nourishing, the fire within the body burns low. We then need more clothing and more warmth from the outside. It is neither cheap nor health-giving to eat poor food. When poorly fed and poorly clothed, the body becomes weak and unhealthy. Well-clothed people require less food in cold weather than those thinly dressed.

4. Those who always clothe themselves heavily retain, in part, their summer constitution through the winter. They are tender when cold weather comes, and cannot bear what others do without suffering. Many children wear heavy coats, tippets

about the neck, and often forget to remove them while in the warm school-room. As soon as they go out of doors, the neck becomes chilled. In this way tippets have caused more sore throats than they have prevented. *Never wear a tippet while in doors;* and it is generally best not to wear one unless it is very cold.

(*b*) **Qualities of Clothing.** — **1.** *Woolen clothes*, being coarse and porous, detain within their meshes considerable quantities of air, and this causes them to conduct heat slowly. They are the kind best adapted to prevent the heat of the body from escaping rapidly, and are best suited to cold weather.

2. *Cotton clothing* is a better conductor of heat than woolen, and is therefore not so warm. Cotton does not absorb moisture from the body as rapidly as linen does, nor so slowly as wool does. It is the best for under-garments, because it is desirable to prevent the too sudden cooling of the body by rapid evaporation of the perspiration.

3. *Linen clothing* is a rapid conductor of heat. It also quickly absorbs perspiration, and allows it to evaporate freely. In this way, its cooling effect is very rapid; and while it cools the body, it does not properly protect it from sudden chill or change of the temperature of the air. It should never be worn next the skin.

(*c*) **Care of Clothing, and Cleanliness.** — **1.** *All clothing should be kept clean.* Under-clothing, especially, absorbs perspiration, and becomes filled with

the waste from the skin. Some of this matter may be absorbed and carried back into the blood, or at least prevent air from passing as freely through the clothing as it should. A neglect to change clothing frequently is not only a filthy habit, but is one cause of disease in uncleanly persons.

2. *There should be an entire change of clothing on going to bed.* The clothing worn during the day should be allowed to air and dry, and be well shaken before being put on again.

3. *The night-clothing and the bed-clothes and beds should be thoroughly aired every day.* If this is not attended to, they will remain damp from the moisture they absorb, and will cause chill when next used. Besides, the night-clothing as well as the day-clothing becomes charged with impurities from the body, and may become a source of disease.

4. *Wet clothing should be changed immediately.* It chills the skin and thus prevents the perspiration tubes from performing their work. When the garments cannot be changed at once, the person should not sit still and shiver, but should exercise moderately, and in this way keep up the warmth of the body. Children frequently come to school in stormy weather, and sit with wet clothing and wet feet. This should be prevented.

5. *Sudden change from thick to thin clothing is dangerous.* It is far better to make the change gradually, allowing the body to become accustomed to it safely.

TASTE AND SMELL.

LESSON VIII.

TASTE AND SMELL. — NARCOTICS.

(*a*) **The Tongue.** — **1.** The tongue, the organ of taste, consists of muscles, some of which attach it to a bone at its root, to the lower jaw, etc. The fibres of its muscles interlace so curiously that it is capable of a great variety of motion. It can raise or lower itself, shrink or expand, narrow its end to a point, bring its sides together so as to form a tube or canal, or carry its tip to any part of the mouth in which food may become lodged.

2. The tongue has three large nerves, one of which gives it motion, and the other two are the sensitive nerves of taste. The mucous membrane which covers the tongue is raised into great numbers of little points, and to these go the fine threads of the nerves of taste. When substances which dissolve more or less are placed on the tongue, they cause a peculiar effect, each in its own way. The sensation is carried by the nerves to the brain, and is known by it as *taste*, — sweet, sour, bitter, salt, pleasant or disagreeable. Food and drink must remain in the mouth for a certain time in order that their full flavor may be known. For this reason people keep pleasant-tasting things in their mouths awhile before swallowing them; but when disagreeable medicine is taken, how quickly they try to have it pass over the

tongue and escape the nerves of taste, lest they report unpleasant news of it!

(*b*) **The Nose.** — **1.** The sense of smell is located in the delicate lining (mucous membrane) of the upper portion of the air-passages of the nose. This portion of the lining contains a fine network of branches of the nerve of smell. The ends of these little nerves extend directly to the surface of the lining, so that the particles of the substances we smell may come in very close contact with them.

2. Substances that can be smelled give off atoms so very small that they cannot be weighed or measured. These little particles are breathed in with the air in which they float, and come in contact with the fine nerve-ends, and produce an effect upon them. The nerve of smell then conveys the impression to the brain, and there it becomes known as an *odor* or *smell.*

(*c*) **Uses of Taste and Smell.** — **1.** The senses of taste and smell are our chief guides in choosing food. They are very closely related, and the sense of taste is greatly aided by the sense of smell. When for any reason the sense of smell becomes blunted, taste becomes less delicate and keen. They are twin senses, and most things that are disagreeable to one are so to both.

2. The sense of taste gives us a pleasure which we would not have without it in taking food. It becomes educated to warn us against swallowing many substances which would do great injury or

cause death if taken into the stomach. If the milk or the bread is spoiled and sour, the egg stale, etc., taste and smell give us the needed caution.

3. The sense of smell gives us information, which we cannot obtain by any other sense, about substances in the form of vapors or gases. This sense stands as a sentinel on guard, and examines all the in-coming air breathed by the nose. It warns us instantly of the presence of dangerous gases, or of other odors that are enemies to health, while it finds pleasure for us in every sweet-smelling flower.

4. The senses of taste and smell are frequently injured and made less delicate by abuse of them, and by disease.

(*d*) **How Taste and Smell may be injured.** — **1.** *Tobacco* and *alcohol* when habitually used benumb the nerves of taste, and they become unable to detect delicate flavors. The sense of taste sometimes is so deadened that plain food becomes insipid; and then those who use much tobacco or alcohol resort to strongly spiced or "seasoned" food, in order to excite the taste. The highly seasoned food first sharpens and then still further benumbs the sense of taste.

2. Dryness of the lining membrane of the air-passages of the nose, or its frequent irritation by colds, tends to blunt the sense of smell. The smoke of tobacco contains many fine particles which lodge in the passages and dry and irritate them, and inflamation there may cause catarrh, which either injures or entirely destroys the sense of smell.

3. Of all our senses, smell is the one that soonest gets out of practice, so much so that numbers of people really do not perceive disagreeable smells at all. If they always accustomed themselves to take notice, and to use their noses, they would never consent to live in the horrid air they do. A stupid person takes no notice, and then his nose gets used to disagreeable smell, and leaves off perceiving it.

TEST QUESTIONS.

THE FRAMEWORK.

Lesson I. — (a), 1. What form the framework? Why are the bones like the timbers of a house? What if our bodies were boneless? Of what is bone made? — 2. What happens when a bone is burned? What when it is soaked in acid? Of what use is the lime in the bones? Of what use is the glue-like part? What if there were no lime in the bones? What if they were formed entirely of lime? What would you not then dare do? Compare the bones of young people with those of the aged. — 3. Mention the different forms of the bones. What do you know of the long bones? Of the flat bones, as in the skull? Of the short bones? How is every part fitted, and for what purposes are all the bones joined? — (b), 1. Tell about the joints of the skull. What name is given the joints of the skull, and in what do they aid? — 2. Where are movable joints to be found? How lasting are they? Compare the joints of our body with those of machines. How are our joints fitted to move easily? In what ways may our joints be injured? What is a sprain, and what may cause it? What of injury by rough play? — 3. What are ball-and-socket joints? What do you know of their motion? Why is the shoulder-joint easily "put out"? Describe the hip-joint. — 4. Where are hinge-like joints? How many bones are in the arm below the elbow, and what movement can one of them make? How many bones are in the wrist? How many in a finger? In a thumb? What makes the hand so capable of handling? To what does man owe his superiority?

Lesson II. — (a), 1. What is the shape of the chest? Tell about the ribs. What does the chest contain? — 2. Tell what you know of the backbone. Why is it not a single bone? Where and what is the spinal marrow? — 3. What is between each two of these bones? Of what use are these pads? Why are we not quite as tall in the evening as in the morning? What of the backbone's length in old age? Is it straight?

— (b), 1. What of the bone of the thigh? By what is the knee protected? Tell about the bones of the leg below the knee. — 2. How is the foot formed? How many bones in it? What of its motion? Why is it arched?

Lesson III. — (a), 1. Upon what does the health of the bones depend? — 2. What if a child has no exercise, etc.? — 3. What gives the bones good size and strength? — (b), 1. How may the bones of the spine and chest be distorted? Tell about the bad effects of tight clothing about the chest. How should clothing be about the chest, and why? — 2. How should you sit and stand? Tell about the bad effects of improper posture. What of the height of your desk? — 3. Tell about the harm done by tight shoes. Why are high heels injurious? — 4. What may have induced consumption in some people?

Lesson IV. — (a), 1. When are the first teeth shed? What are they called, and how many are there? What takes their place? Of what are the teeth composed? — 2. Why are the first teeth shed? — (b), 1. How should the teeth be cared for after a meal? — 2. Tell how to brush the teeth well. Which need most brushing? What of brushing the gums? — 3. What kind of brush is best, and why? — 4. What of strong soaps? What of powders? Of hot and of cold water? Of tepid water? What makes a good tooth-powder? — 5. For what were the teeth not intended?

DIGESTION.

Lesson I. — (a), 1. What are the lungs and pores of the skin constantly casting out? — 2. What if new material be not supplied the body? What of the nerves of the stomach when food is needed? — (b), 1. From what does bodily strength come? What does the food furnish the body? — 2. How does bodily waste vary? — (c), 1 and 2. What is digestion? — (d), 1. Name the organs of digestion. — 2. What is the alimentary canal?

Lesson II. — (a), 1 and 2. Tell about the work of the mouth in changing the food. Tell about the saliva or spittle. — 3. When the work of the mouth, etc., is completed, what happens? Tell about the œsophagus, and how food is swallowed. — (b), 1. Where is the stomach? What of its shape and coats? — 2. What occurs when food enters the stomach? Tell about the action of the gastric juice. What is chyme? What becomes of it? — (c), 1. What occurs when the chyme enters the intestines? Upon what do the two juices act? What is chyle? — 2. What becomes of the chyle? Into what is it poured at last?

Lesson III. — (a), 1. When should meals be eaten, and why? How often? — 2. When does the stomach work best? Tell about eating after play. Tell about exercise after eating. About a meal before going to bed. — (b), 1. What is said of eating hurriedly? What of taking too much food and its bad effect? — 3. What of taking frequent swallows of tea, coffee, etc., while eating? What effect have cold liquids on digestion? When is it best to quench thirst? — (c), 1. Of what are our bodies composed? What, then, should our food contain? Why is it best to eat more than one article of food? — 2. What kind of diet is best? Tell what different articles of food supply to the body. Tell the kinds of food eaten by people in various climates. — 3. What often makes food unhealthful? What of mixtures in cooking? What should be done when food causes discomfort? What will result from carelessness in taking food?

Lesson IV. — (a), 1. What is the danger of impure drinking-water? What is said of wells in old cities and villages? — 2. What is said of detecting impure water by taste and smell? — (b), 1. How may water become impure? What can you say of shallow wells and filthy ground? — 2. What of the purity of wells in the country? What of cesspools, slops, etc., about them? What of filthy ground in cities making water impure? — 3. What is certain when there is carelessness about good drainage and cleanliness? What lesson should be learned by all? What cannot be had if filth is not promptly removed? — 4. What recently caused a terrible epidemic of fever in one of our towns?

Lesson V. — (a). What are stimulants? — (b). What are narcotics? How do they produce their effects? What injury do they produce? (c). What stimulants and narcotics are particularly mentioned, and why? In what are these much alike? What may the use of one of them lead to? What is alcohol, and in what is it harmful? What is opium? Tell about its power. In what is it often used? What is tobacco? By what are its bad effects caused? What is chloral? What of its danger? — (d). Tell about the appetite that these drugs arouse. — (e), 1. How does alcohol injure the stomach? How does it affect certain food articles in the stomach? What of alcohol and the gastric juice? What are its principal effects here? — 2. How does it injure the liver and kidneys? What is "drinker's liver"? Why is an injury to the kidneys serious? — (f). In what way do smoking and chewing of tobacco interfere with digestion? What diseases may tobacco cause? How does tobacco injure young people? — (g). In what ways do opium and chloral interfere with digestion? Tell about the appetite they fix upon people. When only should they be used?

THE BLOOD.

Lesson I. — 1. What is the blood, and what does it carry? Of what is it made? What, if we would have good blood? — 2. What materials does the blood contain? When it does not contain these, what may we conclude? — 3. What is the plasma? What are corpuscles? Tell about both kinds of corpuscles. What do they carry? — 4. Tell about the general movements of the blood. Name the organs that circulate it.

Lesson II. — (a), 1. What is the heart, and where is it? — (b), 1. Tell about its form and size. — 2. What surrounds it? Tell about this sack. — 3. How many chambers has the heart, and what are their names? — 4. How are the chambers connected, and how separated? — 5. Tell about the walls of the ventricles as compared with those of the auricles. — 6. Why do not the auricles need so much power? — (c). Tell about the action of the heart, and the movements of the blood through it. Out of which chamber is the blood pumped into the great artery? To what do this artery and branches carry it? — (d). What are arteries? Tell about the aorta. Where are most of the arteries located? Why do they lie so deep? Tell about the difference in the flow of blood from an artery and that from a vein. — (e). Tell about the capillaries. What passes out though their walls, and for what purpose? — (f). Tell about the veins. Into what do they finally become united? Tell about the kind of blood in the arteries as compared with that of the veins. How long does it take all the blood to pass once through the heart?

Lesson III. — (a), 1. Why must the blood circulate freely? What bad effect has tight clothing? — 2. Tell about the effects of tight clothing about the neck. — 3. Of tight clothing about the waist. — 4. What of tight bands about the limbs? — 5. Of tight shoes and gloves? — 6. Of insufficient clothing? — (b), 1. What bad effect has anger, etc., on the heart's action? — 2. How do sorrow and grief affect the movement of blood and the health? — 3. Good nature? — (c), 1. Tell about the good effects of bathing and friction of the skin. — 2. About muscular exercise and its good effects. — (d), 1. What things should be avoided? — 2. Why should not the heart be unduly excited? — (e), 1. How does alcohol treat the blood and its corpuscles? Tell about fevers and liquor-drinkers. — 2. How does alcohol affect the heart? What of fattening the heart and muscles of the blood-vessels? — Tell about alcohol as a protection against cold. Does it so protect? — (f). What is the effect of tobacco upon the blood? — Upon the heart?

BREATHING.

Lesson I. — (a). How does air get into the lungs? — (b), 1. Tell about the larynx, or "Adam's apple." Tell about the glottis and epiglottis. What occurs if we attempt to swallow when we breathe? — 2. Tell about the larynx as the instrument of voice. At what time of life does it increase in size, and what follows? — (c), 1. Tell about the windpipe and its branches. — 2. With what are the air-tubes lined? — (d), 1. Where are the lungs? Tell about their substance and color. What causes them to act in breathing? Describe breathing by the lungs. — 2. How does oxygen get into the blood, and what effect has it? What comes out from the blood in the lungs? What, then, is the work of the lungs?

Lesson II. — (a), 1. Of what is air composed? What if it consisted of oxygen only? — 2. Tell about the value of oxygen. — (b), 1. What depends upon the quality of the air we breathe? — 2. Tell about the effects of breathing pure and impure air. — 3. What results follow breathing of bad air? Of pure air? — (c), 1. How much air is taken in at a breath? What causes the air of a room to soon become impure? — 2. What of gases from cesspools, etc.? From decaying vegetables and slops, etc.? How shall we guard against these dangers? — 3. Tell about the bad effects of not raising windows. — 4. Tell about the harm from sleeping with the head under clothes.

Lesson III. — (a), 1. Why are food and air necessary? — 2. What becomes of the oxygen we breathe, and what does it do? — 3. Why, then, do we breathe? — (b), 1. Why is it best to breathe through the nose? — 2. Tell about sufficient breathing. What results if we do not take sufficient air at each breath? — 3. Tell what things prevent sufficient breathing. How frequently does a healthy person breathe? How often, and why, do some people partly fill their lungs? — (c), 1. How does alcohol injure the lining of lungs? What trouble does this cause? What of a "cold" and of inflammation of the lungs in those who drink liquor? How does alcohol interfere with the blood? — 2. How does tobacco-smoke harm the lungs? What of the death of a young man from smoking? Why are cigarettes most injurious?

Lesson IV. — (a), 1. What is it to ventilate a room or place? When have we proper ventilation? — 3. Why do many people fear to open windows? What do we notice on entering a close room? What must be guarded against in ventilating? — (b), 1. What is said of the danger of breathing air in close rooms? — 2. Tell what is said of the time spent in sleeping-rooms, and of not allowing fresh air to enter them.

What bad effects follow? What should be done? — (c), 1. Why are not some plans of ventilation employed? — 2. Tell how a room may be safely ventilated by window ventilation. — (d), 1. How warm should rooms in which we sit be? Those in which we work? Tell about allowing rooms to become too warm, and then throwing doors and windows open. Why is this wrong? What is said of the guide for warmth? What of going out from rooms that are too warm? — 2. Tell about the management of stoves and furnaces. About moisture of the air of rooms, and how to keep it moist.

Lesson V. — (a), 1. On what kind of ground, etc., should houses be built? What if the cellar would be damp? — 2. How should the ground be make to slope, and why? — 3. What of trees near the house? How should the trees be situated, and why? How is the best light obtained? What of slops thrown on the ground? — (b), 1. What quality of material should be used in school-buildings? What of the size of rooms? What is of first importance? Tell about the size of room suited to forty pupils. — 2. What of the windows, and of entering light? Of the color of ceiling and walls, and why? — 3. Where should the light not enter, and why? Where should light enter, and why? What of sunlight? Tell about the position of blackboards, etc. What of the quantity of light? Of glare? What should we all learn as to this, and why? — 4. What of doors, transom windows, and stairs? — 5. What of the position and height of school-desks? — 6. What about outer garments, wet clothing, lunch-baskets, etc.?

THE MUSCLES.

Lesson I. — (a), 1. What are the muscles? What does the body owe to them? — 2. To what are the muscles and tendons compared? — 3. To what parts of a machine are the bones similar? — The muscles? — 4. What of lean meat? — Of the number of muscles? — (b), 1. Where are the muscles? Mention some within the framework. — (c), 1. Of what are muscles made up, etc.? — 2. How are they placed, and how separated, etc.? — 3. Tell their shapes and lengths. — 4. Tell about the *swell*, *insertion*, and *origin* of muscles. — 5. Describe the tendons. — 6. Tell about arteries and nerves of the muscles.

Lesson II. — (a), 1. What causes all bodily movements? — 2. Tell how the muscles produce motion. In what is a good example of this found? What are flexors and extensors? — 3. How many are arranged in pairs, and why? — 4. Do all muscles move joints? Explain. — 5.

Tell about the muscles of the face. — 6. Tell about bands of ligament, and their uses. — (b), 1 and 2. Tell about voluntary and involuntary muscles. — (c), 1 and 2. Tell how the muscles are made to contract. — 3. What if a nerve be cut?

Lesson III. — (a), 1. What is the law regarding exercise? Tell about the effects of lack of exercise. —2. What care must be taken in exercising? — (b), 1 and 2. Tell how exercise affects the flow of the blood, the work of the heart, lungs, etc. — (c), 1. Tell how exercise aids appetite and digestion. — (d), 1. Tell about exercise and pure air. — 2. Exercise and mental labor. — 3. What of daylight and exercise? — 4. What of exercising a large number of muscles, and how? — 5. What of taking exercise regularly and gradually? What should be avoided, and why? — 6. What of pleasant state of the mind while exercising? What of gloominess and exercise? — (e), 1. Tell about walking as an exercise, and how it should be engaged in. — 2. What of running? — 3. Tell about the benefits of swimming. — 4. Tell about rowing, and what it may cause. What is the best position, for health, in rowing? — 5. Tell about the benefit of gymnastics and the use of light dumb-bells. — 6. What about the clothing and exercise? — (e). How does alcohol cause us to lose control of the muscles? How does this finally affect men, even when they are sober? What about alcohol changing muscle into fat? What danger lies in this change?

THE BRAIN AND NERVES.

Lesson I. — (a), 1. Where is the brain? — 2. Tell about its two divisions. — (b), 1. Tell about the coats of the brain, and describe each. — 2. Tell about the substance of the brain. — (c), 1. What of the brain and thought? — 2. Tell about the work of the divisions of the brain. Which is supposed to regulate muscular movements?

Lesson II. — (a), 1. From what do the nerves spring? — 2. What are cranial nerves? — 3. Tell about the spinal cord. About the spinal nerves. — 4. How do the nerves branch out? — (b), 1. Tell about the pairs of nerves. About the nerves of the skin. What form the nervous system? — 1. Tell about the work of the nervous system. — 2. What are sensory nerves? Motor nerves? Tell about their work. What is the nervous system like?

Lesson III. — What things are first of all necessary to a healthy brain, etc.? — 2. What of regular hours for work and play, and why? — 3. What of loss of sleep, and the nervous system? Tell about hours

and time for sleep. What is best when we are wearied by brain-work, etc.? Tell about the brain needing rest. What about the kind of pillow?—4. Tell what is said of study at night. In the morning.—1. Tell what alcohol does to the blood-vessels of the brain. About softening of the brain by alcohol.—2. How does alcohol affect the nerves? Tell about delirium tremens.—3. Tell how alcohol affects the will. How it affects the mind. Tell about its causing loss of good name, property, and business. Tell about alcohol leading to crime.—(b), 1. What is opium like in many effects? How does it affect the brain and nerves, and self-control? What is the condition of those who meddle with it?—2. Tell about tobacco as a brain-poison. How does it affect the memory and disposition? Tell about appetite for tobacco.

THE SPECIAL SENSES.

THE EYE.

Lesson I.—(a). Where and how is the eye situated?—(b), 1. Tell about the coats of the eye, their names, etc.—2. Tell about the selerotic coat and its office. About the choroid coat. About the retina, and how it is related to sight.—3. About the cornea.—4. What and where is the iris? The pupil, and how it acts?—5. Tell about the crystalline lens and its work.—6. Tell about the aqueous humor, and what it does. About the vitreous humor, and what it does.—7. Tell about the optic nerve, where it begins, etc.—8. Describe the tear-gland, and what it does. Tell about the canals that lead into the nose.—(c), 1. Tell what we know of how we see.—2. Tell about the contraction of the pupil in strong light, and when there is little light.

Lesson II.—(a), 1. Tell how to care for the eye in working by lamplight.—2. How does long-continued work affect the eye? Tell about resting the eyes. Tell about having clear, steady light. About continuing eye-work too long. What, when the sight begins to blur?—4. Tell about glaring light.—5. Tell about twilight, and dim light, and the eyes. About work on dark surfaces.—6. What of reading while walking or while lying down?—7. Tell about holding the book close to the eyes, and bending over our work.—(b), 1. Tell about near-sightedness, and how much of it is caused.—2. What about care in securing good light, and by whom? What relieves near sight? What may prevent it?—(c). Tell about far-sightedness. What relieves it?—(d). Tell about color-blindness. Why should you attend to colors?—(e), 1. Tell about postponing the

use of glasses. Tell about near-sighted children in school without glasses. Can poor sight always be corrected without glasses? Can poor sight always be cured? What of the good effect of glasses?—2. What caution should we use in selecting glasses? To whom should we entrust their selection, and why? To whom should we not entrust the selection of glasses, and why not? Tell how glasses should be constructed to be of use. What of glasses that do not give ease to the eyes? Tell about the "looks" of wearing glasses.—(f), 1. Tell about the size of type, and the distance of the book in reading. When should glasses be worn, then? What is the bad effect of fine type? What is the most frequent cause of near-sightedness? Tell about too coarse print with a wide page, and its bad effects on the eyes.—2. Tell about the tint of the paper, and dazzling glare. What tints are not best? What tint has been found best for the eyes?—(g), 1. What should you do when your eyes become diseased? What should you not do?—2. If matter forms, what care should be taken? What of all articles used about sore eyes?—3. How may cinders, etc., be removed from the eye? Lime?—(h). How does tobacco-smoking affect the eyes? Why are cigarettes most injurious to the eyes?

THE EAR.

Lesson III.—(a). Of what does the ear consist?—(b), 1. Tell about the external ear. About the auditory canal.—2. Tell about the middle ear, or drum. About the Eustachian tube. About the little bones.—3. Tell about the internal ear.—(c), 1. What do things do that make sounds? Tell about the air-waves.—2. What of the air-waves and the drum-head? What do the little bones do, and what then? Where is part of the auditory nerve, and what does it do?

Lesson IV.—1. What bad effects from draughts of air?—2. Tell about cold water getting into the ears, and about its pressure. How may water be got out of the ears?—3. Tell about injury to the ear from diving.—3. Tell about blows upon the ears.—5. Tell about loud sounds made near the ear. About clashing stones while under water.—6. Tell the bad effects of smoking tobacco, and of breathing through the mouth.—7. What is the use of ear-wax? What, when it becomes hard in the ear? How may it then be removed? How should it not be removed, and why?—8. How may an insect be removed from the ear? What if this does not remove it?—9. What, when a pea or bean is pushed into a child's ear? What, when a hard body—a button or bead—is in the ear? How should the syringe be used in this case?

THE SKIN.

Lesson V. — (a). What is the skin? — (b), 1. Of what layers does it consist? Tell about the scarf-skin. — 3. Tell about the true skin, and what it is filled with. — 4. Tell about the arteries, veins, etc., of the skin. About the nerves. About lymphatics and oil-tubes. — (c), 1. Tell about the skin as a protector. For what is it an outlet? — 2. Tell about the work of the perspiration-tubes. About sensible and insensible perspiration. — 3. Tell about the work of the oil-tubes. Of the work of the lymphatic tubes. Tell about absorbing substances into the blood through the skin. — 4. Tell about the nails, and hair, and their uses. — 5. Tell about the coloring-matter of the skin. — 6. Tell about the skin regulating the warmth of the body. — 7. To what does the sense of touch belong particularly? Are all portions of the body sensible to touch? Why not? Tell about the tips of the fingers and touch. — 8. Who have very keen sense of touch? Tell about the blind boy learning to know things after his sight was recovered.

Lesson VI. — (a), 1. Tell about the quantity of waste matter the skin sends out. What if its pores become closed? What other organs would then have extra work? — 2. How may the extra work affect the other organs? What bad effects would follow if they become unable to do the extra work? Tell how closed pores may cause fever. How must the skin be cared for if we would have good health? — (b), 1. How often should we bathe in summer? What is the best time for a bath? When is it not best? — 2. Tell about careless bathing. What effects tell us that we have bathed at an improper time or in an improper way, etc. ? — 3. Tell about the temperature of the water for a bath. What of hot baths? Tell about exposure after a hot bath, and why care must be taken. — 4. What is a cold bath? What temperature in a "cold" bath is best for most people? Why is there no reason for giving up such a bath in winter? How may it be managed? — 5. How should the skin be treated after a bath? What is a good substitute for a bath? — 6. Tell about the use of soap in bathing. What of bathing too long a time? What length of time is best?

Lesson VII. — (a). What is the object of clothing, as relates to health? What of too warm clothing? What of being too thinly clothed? What is to be avoided? — 2. How should the amount of clothing be regulated? — 3. What of the need for clothing when we eat but little, or when food is not good? Is poor food cheap? What, when the body is poorly fed and clothed? What of well-clothed people, and the need of food? — 4. Tell about people who clothe too heavily.

About wearing tippets in warm rooms, and why this is harmful. — (b), 1. Tell about the nature of woolen clothing. To what is it well adapted? — 2. Tell about the nature of cotton clothing. For what garments is it best, and why? — 3. Tell about the nature of linen clothing. About its cooling effect. Where should it not be worn? — (c), 1. Tell about keeping clothing clean, and why. About changing clothing frequently. — 2. About changing it on going to bed. — 3. Tell about airing night-clothes and bed-clothes. — 4. Tell about changing wet clothing, and why. About exercise when the clothing is wet. — About wet clothing at school. — 5. What of changing from thick to thin clothing, and why?

TASTE AND SMELL.

Lesson VIII. — (a), 1. What is the tongue, and of what composed? What movements can it make? — 2. Tell about the nerves of the tongue. About the membrane that covers it. About the fine nerves in it. Tell how we taste. How is the full taste of things to be got? What of things that are disagreeable in taste? — (b), 1. Where is the sense of smell? Tell about the fine nerves in the lining of the nose. Tell about substances that can be smelled. Tell how we smell. — (c), 1. In what do taste and smell act as guides? Tell how they aid each other. What of the pleasure of taste? How does it protect us from harm? — 3. About what things does the sense of smell give us information? In what does it act as a sentinel, and what warning does it give? — 4. How may taste and smell be injured? — (d), 1. How do tobacco and alcohol affect the nerves of taste and smell? How affect taste for plain food? When the nerves become blunted, what about strongly-spiced and seasoned food? — 2. How does dryness of the lining of the nose affect smell? Tell about the effects of tobacco-smoke upon the air-passages of the nose. What troubles may it cause here? — 3. Which of the senses gets out of practice soonest? Tell about keeping the sense of smell in practice, etc.

PRONUNCIATION AND DERIVATION OF TERMS.

KEY TO PRONUNCIATION.

ā, ē, ī, ō, ū, ȳ, long, as in āle, ēve, īce, ōld, ūse, flȳ.
ă, ĕ, ĭ, ŏ, ŭ, ў, short, as in făt, mĕt. ĭt, ŏdd, ŭs, cўst.
å, ä, ạ, as in åsk, ärm, ạll.
ę, ç, as in ęat, çell.
ĕ, ę, as in ĕrmine, ęight.
ġ, ḡ, as in ġem, ḡet.
ṇ, as in liṇk.
ȯ, ô, as in sȯn, ôrder.
s, as in has.
ch = k, as in chorus.
ph = f, as in phantom.

Ăb-dō′men (Lat.), probably from *abdere*, to hide, and *omentum*, entrails.

Ăl-bū′men (Lat.), from *albus*, white.

Ăl′che-my (Arabic), from *al-kama*, the substance or composition of things.

Ăl′co-hol (Arabic), from *al-kohl*, a powder of antimony.

Ăl-i′mĕnt′a-ry (Lat.), from *alere*, to feed.

Ăl′kă-līne (Arabic), from *al-qali*, the ashes of a plant called *glass-wort*: having the properties of alkali.

Ăl′kă-loids from *alkali* and (Gr.) *eidos*, form; the active medicinal or poisonous principles of certain plants.

A-năt′o-my (Gr.), from *ana*, up, and *temnein*, to cut.

Ā-ôr′tă (Gr.), from *aeirein*, to lift, heave.

Ăp′pă-rā′tŭs (Lat.), from *apparare*, to prepare.

Ā′que-oŭs (ā′kwe-ŭs), (Lat.), from *aquosus*, from *aqua*, water.

Ăr′ter-y (Gr.). *arteria*, from *aer*, air, and *terein*, to carry. The ancients believed that the arteries were air ducts.

Ăr-thrō′dĭ-ăl (Gr.), from *arthrodes*, well articulated.

Ăr-tĭc′ū-lāte (Lat.), from *artus*, a joint.

As-phўx′ĭ-ă (Gr.), from *a*, privative, and *sphuxis*, pulse. A stopping of pulse.

Ạu′dĭ-to-ry (Lat.), from *auditorius*, from *audire*, to hear.

Ạu′rĭ-cle (Lat.), from *auricula*, diminutive of *auris*, ear.

Bī′çĕps (Lat.), from *bis*, two, and *caput*, head.

Bī-cŭs'pĭds (Lat.), from *bis*, two, and *cuspis*, point.

Bīle (Lat.), from *bilis*, bile, anger.

Brŏn'chi (Gr.), from *brogchos*, windpipe.

Că-nīne' (Lat.), from *caninus*, from *canis*, dog; *canine* teeth, the sharp, pointed teeth, like those of a dog.

Căp'il-la-ries (rĕz) (Lat.), from *capillus*, hair.

Căp'sūle (Lat.), from *capsula*, a little box or chest, from *capsa*, chest.

Cär-bŏn'ĭc (Lat.), from *carbo*, coal.

Cär'pŭs (Gr.), from *karpos*, the wrist.

Cär'tĭ-lāge (Lat.), from *cartilago*, gristle.

Çĕr'e-bĕl'lŭm (Lat.) diminutive of *cerebrum*, brain. the little brain.

Çĕr'e-brŭm (Lat.), the larger division of the brain.

Chlō'răl (Gr.), from *chloros*, pale green.

Chlō'rīne (Gr.), from *chloros;* a heavy gas, so named from its color.

Chō'roid (Gr.), from *choroeidos*, from *chorion*, skin, and *eidos*, form.

Chȳle (kīl) (Gr.), from *chulos*, juice.

Chȳme (kīm) (Gr.), *chymos*, juice.

Clăv'ĭ-cle (Lat.), from *clavicula*, a little key, from *clavis*, a key.

Cŏc'çyx (Lat.), from *coccyx*, cuckoo. So named from its resemblance to the beak of a cuckoo.

Cŏn-ġĕs'tion (Lat.), from *congestio*, a gathering into a mass.

Côr'ne-å (Lat.), from *cornu*, a horn.

Côr'pŭs-çle (Lat.), *corpusculum*, a little body, from *corpus*, body.

Crys'tal-līne (Lat.), from *crystallinus*, of crystal; from (Gr.) *krystallos*, ice, crystal.

Cū'tĭ-cle (Lat.), from *cuticula*, diminutive of *cutis*, skin.

Dĕ-lĭr'ĭ-um trĕ'mĕns (Lat.), from *delirare*, to go out of the furrow, to wander in mind, and *tremere*, to tremble.

Dī'å-phrăgm (-frăm) (Lat), from *dia*, through, and *phragma*, fence.

Dĭ-ġĕs'tion (dĭ jĕst'yun) (Lat.), from *digestio*, separation, dissolving.

Dĭs'lō-cāte (Lat.), from *dislocare*, from *dis*, apart, and *locare*, to place.

Dĭs-sĕct' (Lat.), *dissecare*, from *dis*, apart, and *secare*, to cut.

Dĭs-tĭll' (Lat.), from *destillare*, from *de*, from, and *stillare*, to drop.

Dȳs-pĕp'si-å (Gr.), from *duspepsia*, from *dus*, ill, and *pessein, peptein*, to cook, digest.

Dŭct (Lat.), from *ductus*, a conduit, from *ducere*, to lead.

Dū'ō-dē'nŭm (Lat.), from *duodeni*, twelve each

Dū′rȧ mā′tĕr (Lat.), from *durus*, hard, and *mater*, mother.

Ĕp′i glŏt′tĭs (Gr.), from *epi*, upon, and *glotta*, tongue.

Eū-stā′chī-ȧn (yū-stā-kĭ-an), from *Eustachi*, the name of a learned Italian physician, who discovered the tube.

Fē′mŭr (Lat.), the thigh bone.

Fĕr-men tā′tion (Fr.), from Lat. *fervere*, to be boiling hot, ferment.

Fī′bre (-bŭr) (Fr.), from Lat. *fibra*, a thread.

Fĭb′ū-lȧ (Lat.), a clasp.

Fūmeş (Lat.), from *fumus*, vapor, smoke.

Fŭnc′tion (Lat.), from *functio*, from *fungi*, to perform.

Găs′trĭc (Fr.), *gastrique*, from (Gr.) *gaster*, the belly.

Glănd (Lat.), from *glans*, an acorn.

Glŏt′tĭs (Gr.), from *glotta*, tongue.

Hū′me-rŭs (Lat.), the shoulder.

Hū′mor (-mŭr) (Lat.), from *humere*, to be moist, liquid.

Hȳ′dro-ĝen (Fr.), from *hydrogene*, from (Gr.) *udor*, water, and *genein*, to beget, produce.

Hȳ′ĝi-ēne (-ēn) (Gr.), from *Hygeia*, the goddess of health.

Ĭm-pŏv′er-ĭsh from prefix *im*, in, and O. French *povere*, poor; a corrupt form based on *apovrir* beggar.

Ĭn-çī′şor (Lat.), from *incidere*, to cut in.

Ĭn-nŏm-i-nā′tă (Lat.), from prefix *in*, not, and *nominare*, to name.

Ĭn-săl′i-vā′tion (Lat.), from prefix *in*, and *saliva*, spittle.

Ĭn′ter-cŏs′tal (Lat.), from prefix *inter*, among, between, and *costa*, rib.

Ĭn-tĕs′tĭne (-tĭn) (Lat.), from *intus*, on the inside, within.

Ĭn-tŏx′i-cāte (Lat.), from *intoxicare*, to drug, to poison; from prefix *in*, and *toxicum*, poison.

Ĭn-vŏl′ŭn-ta-rў (Lat.), from *involuntarius*, from *in*, not, and *voluntas*, will.

Ī′rĭs (Lat.), rainbow.

Lăb′y-rĭnth (lăb′ă-rĭnth) (Lat.), from *labyrinthus*, a maze.

Lăch′rў-mal (lăk′rē-mal) (Lat.), from *lacryma*, a tear.

Lăc′te-ăl (Lat.), from *lac*, milk.

Lăr′ȳnx (-ĭnx) (Gr.), from *larugx*, a whistle; the upper part of the wind-pipe.

Lĭg′ă-ment (Lat.), from *ligamentum*, from *ligare*, to bind.

Lȳm-phăt′ic (Lat.), from *lympha*, a transparent fluid.

Măs′ti-cā′tion (Lat.), from *masticatio*, from *masticare*, to chew.

Me-dŭl'lå (Lat.), narrow.
Mĕm'brāne (Lat.), from *membrana*, a delicate skin.
Mĕt'å-cär'pus (Gr.), from *meta*, after, and *karpos*, wrist.
Mĕt'å-tär'sus (Gr.), from *meta*, after, and *tarsos*, ankle.
Mī'tral (Lat.), from *mitra*, a cap with two points or peaks.
Mō'lar (Lat.), *molaris*, from *mola*, mill, from *molere*, to grind in a mill.
Môr'phī-å (Gr.), from Morpheus, the god of dreams and sleep.
Mō'tor (Lat.), from *movere*, *motum*, to move.
Mū'coŭs (-kŭs) (Lat.), *mucosus*, from *mucus*, slime.
Mŭs'çle (mŭs'sl) (Lat.), from *musculus*, a little mouse, from *mus*, a mouse.
När-cŏt'ĭc (Gr.), from *narke*, numbness, torpor.
Nā'ṣăl (Lat.), from *nasus*, nose.
Nī-trŏg'e-noŭs (Gr.), from *nitron*, nitre, and *genein*, to beget, produce.
Noŭr'ĭsh ĭng (nŭr) (Lat.), from *nutrio*, feed, support.
Oē-sŏph'å-ġŭs (ē-sŏf'å-ġŭs) (Gr.), from *oiso*, to carry, and *phagein*, to eat.
Ôr'gan (Lat.), from *organum*, an instrument.
Ŏx'ў ġĕn (Gr.), from *oxus*, sharp, acid, and *genein*, to beget, produce.
Păl'åte (Lat.), from *palatum*, the roof of the mouth.
Păn'erē-ås (Gr.), from *pan* all, and *kreas*, flesh.
Păr'å-lўze (-līz) (Gr.), from *para*, beside, and *luein*, to loosen.
Pa-rŏt'ĭd (Gr.), from *para*, beside, near, and *ous*, ear.
Pa-tĕl'lå (Lat.), diminutive of *patina*, a dish.
Pĕl'vĭs (Lat.), a basin.
Pĕp'sĭn (Gr.), from *pepsis*, a digesting.
Pĕr'i-cär'dĭ-ŭm (Gr.), from *peri*, about, and *kardia*, the heart.
Phā-lăn'ġēṣ (Gr.), plural of *phalanx*, from *phalagx*, a rank.
Phăr'ўnx (-ĭnx) (Gr.), from *pharugx*, the gullet.
Phўṣ ĭ-ŏl'ō ġў (Gr.), from *phusis*, nature, and *logos*, a description.
Pī'å mā'ter (Gr.), from *pia*, tender, and *mater*, mother.
Plăṣ'må (Lat.), *plasma*, anything formed.
Pleū'rå (Gr.), *pleura*, properly a rib, the side.
Pneū mō'nĭ-å (Gr.), from *pneumones*, the lungs, from *pneuma*, air.
Pŭl'mo-na-rў (Lat.), from *pulmo*, a lung.
Pûr'ġå-tĭve (Lat.), from *purgare*, to make clean.
Pў-lō'rŭs (Gr.), *pyloros*, a gate-keeper, from *pyle*, a gate.
Rā'dĭ ŭs (Lat.), a staff, a ray, a spoke of a wheel.
Rĕt'i-nå (N. Lat), from Lat. *rete*, a net.

Sā′crŭm (Lat.), from *sacer*, sacred.

Sa-lī′vå (Lat.), spittle.

Scăp′ū-lå (Lat.), the shoulder blade.

Sclē-rŏt′ĭc (Gr.), from *skleros*, hard.

Se-bā′ceoŭs (-shŭs) (Lat.), from *sebum*, tallow.

Sĕn′sŏ-rў (Lat.), from *sentire*, *sensum*, to perceive by the senses.

Skĕl′e ton (Gr.), from *skellein*, to dry up.

Spīne (spīn) (Lat.), from *spina*, a thorn.

Spōre (spōr) (Gr.), from *sporos*, a sowing, seed.

Stĕr′nŭm (N. Lat.), from (Gr.) *sternon*, the breast.

Stĭm′ū-lant (Lat.), from *stimulare*, to spur on.

Stŏm′åch (stŭm′ak) (Lat.), from *stomachus*, (Gr.), *stomachos*, from *stoma*, a mouth, an entrance.

Stū′pe-fў (Lat.), from *stupere*, to be struck senseless.

Sŭb-lĭn′gual (-lĭŋ′gwal), from (Lat.) *sub*, under, and *lingua*, the tongue.

Sŭb-măx′ĭl-la-ry (Lat.), from *sub*, under, and *maxilla*, the jaw-bone.

Sūt′ūre (yūr) (Lat.), from *sutura*, from *suere*, *sutum*, to sew or stitch.

Sўn-o′vĭ-ål (Gr.), from *sun*, with, and *oon*, an egg.

Sўs′tem (Gr.), from *sun*, together, and *istemi*, I place.

Tĕn′dŏn (N. Lat.), *tendo*, from Lat. *tendere*, to stretch out.

Thō-răç′ĭc (Gr.), from *thorax*, the chest.

Thŏ′răx (Gr.), the chest.

Tĭb′ĭ-å (Lat.), the shin bone.

Trā′chĕ-å (Gr.) from *trachus*, rough.

Trī-ĕŭs′pid (Lat.), from *tri*, *tris*, three, thrice, and *cuspis*, *cuspidis*, a point.

Tўm′pa-nŭm (Lat.) *tympanum*, (Gr.) *tympanon*, a drum.

Ŭl′nå (Lat.), the elbow.

Vălve (Lat.), from *valvo*, a folding door.

Veĭn (Lat.), from *vena*, a blood vessel.

Vēn′trĭ-cle (Lat.), from *ventriculus*, from *venter*, the belly.

Vĕr′tĕ brå (Lat.), from *vertere*, to turn.

Vī′brāte (Lat.), from *vibrare*, *vibratum*, to move to and fro.

Vī′tal (Lat.), from *vita*, life.

Vĭt′re-oŭs (-ŭs) (Lat.), from *vitreus*, from *vitrum*, glass.

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